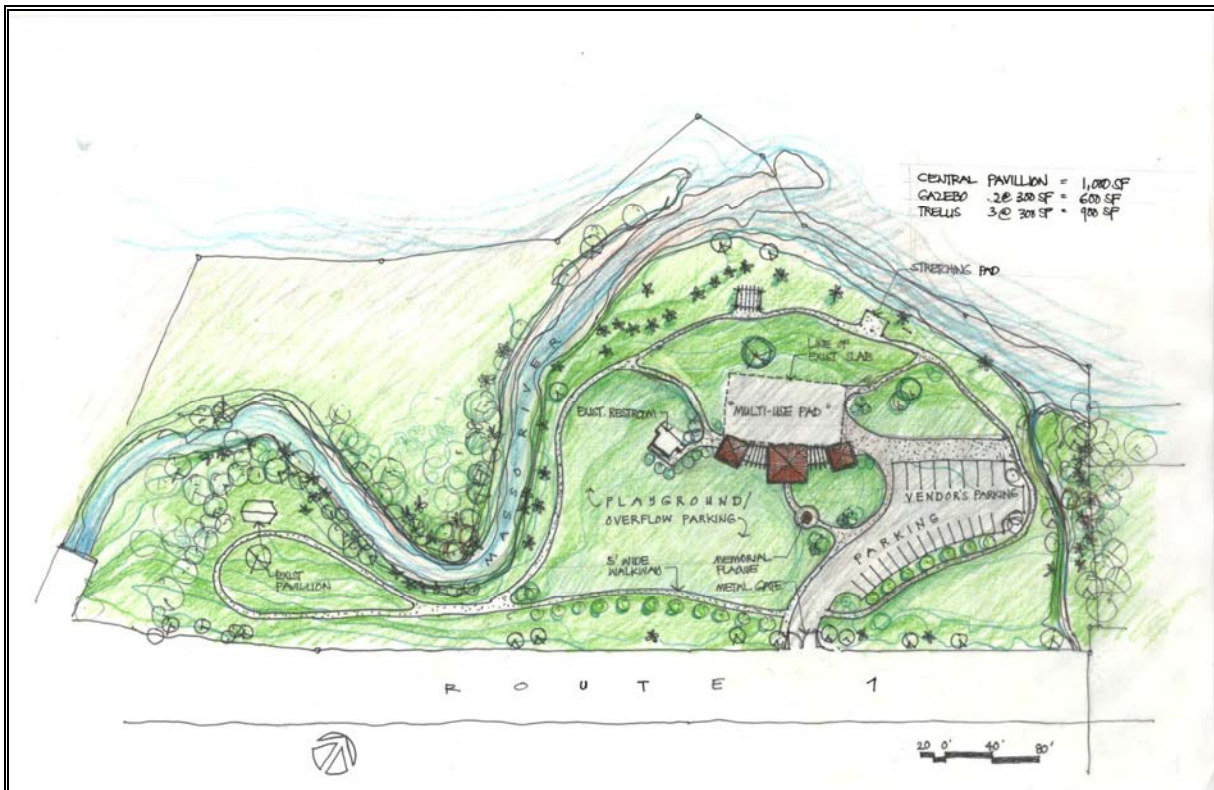


SANTOS MEMORIAL PARK FEASIBILITY STUDY



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Santos Memorial Park Feasibility Study

Executive Summary

This report evaluates the feasibility of implementing improvements at the Santos Memorial Park in Piti, Guam. The proposed improvements would enhance the existing site by constructing a new parking lot area and pavilions, site lighting, repair of existing restroom facilities, connection of restroom facilities to the existing public sewer, repair of existing pavilions, landscaping, and creating a nature/exercise trail. The 6.5-acre project site is located along the shore of Piti Bay and extends inland to the north side of Route 1 (Marine Corps Drive). The Masso River flows through the west side of the park and empties into Piti Bay. The United Seamen's Service is located to the west of the park, while private lots abut the eastern boundary.

Santos Memorial Park experiences a persistent problem of shoreline erosion from coastal wave action. In addition, during high intensity rain storms, sediment particles from upland erosion are carried by the Masso River into Piti Bay.

This feasibility study identified two separate on-going government-sponsored projects that may reduce the amount of sediments being deposited into Piti Bay. The Guam Department of Agriculture Division of Forestry is currently conducting a reforestation of the Cetti Watershed and surrounding areas. The Guam Department of Agriculture Division of Aquatic and Wildlife Resources (DAWR) has proposed to dredge the Masso Reservoir, located upstream from the Santos Memorial Park, and install permanent sediment traps on the Masso River. The reforestation effort represents a long-term solution to controlling erosion, while the proposed dredging and installation of sediment traps by DAWR will remove the fine particle sediments settled at the bottom of the Masso Reservoir and likely produce an immediate reduction in sedimentation.

The preferred park improvements include a central pavilion with two smaller flanking pavilions south of the existing basketball concrete slab to be incorporated as a multi-use pad to accommodate a variety of park and village uses. Parking is located to the east, near the small creek and will include site lighting. The green area to the west will be used as a playground and for overflow parking should it be needed. A memorial plaque will be located between the parking area and the center pavilion.

The existing restroom facility will be upgraded in place without any increase in its footprint or addition of walls and connected to the existing sewer. Existing columns near the river will be provided with a new trellis "open-roof".

The park will be encircled with a paved walking/running path extending along the shoreline reserve, river, and to the existing picnic pavilion in the southwest corner of the site. Stretching pads, concrete benches and other amenities will be located along the walkway.

A new lockable entrance gate will be provided. The park identification sign will be incorporated in the gate.

Santos Memorial Park Feasibility Study

I. INTRODUCTION

The Santos Memorial Park is located in the municipality of Piti, on Lot #262 and has an area of approximately 6.5-acres. The existing concrete structures within the site consist of two pavilions, a restroom facility, and a paved area once used as a basketball court. One of the two pavilions located along the beach has a severely deteriorated roof and the restroom facility is currently not functioning.

The Masso River flows through the western boundary of the park and empties out into Piti Bay, also locally known as Tepungan Bay. Typical beach strand species such as Pago (*Hibiscus tiliaceus*) were found along the Masso River. Turf grass, along with several coconut and ironwood trees have been planted along the shoreline as a shoreline erosion control measure. However, the southwest side of the beach front has visible signs of shoreline erosion despite the presence of turf grass. In addition, during periods of intense rainfall, the Masso River deposits sediment from upland erosion into Piti Bay.

II. SCOPE OF WORK

The Bureau of Statistics and Planning through the Department of Public Works (Project No. 310-5-1022-F-PIT) have hired the services of Duenas Camacho & Associates (DCA) to provide archeological, architectural, geotechnical, structural, civil, mechanical, electrical engineering, and environmental services to initially investigate the feasibility of improvements and controlling soil erosion occurring in and around Santos Memorial Park. The project objectives are to assess existing site conditions, develop feasible alternatives for storm water and other park improvements, and to provide complete design services for the preparation of plans, specifications, and estimates needed to procure construction bids for an acceptable program of improvements.

The core project team consisted of Ms. Darlene Moore from the Micronesian Archaeological Research Services (MARS), Mr. Tom Camacho from Duenas Camacho & Associates (DBCA), Mr. Mark Ruth from Taniguchi Ruth Makio & Associates (TRMA), Mr. Alex Andres of EMCE, and Mr. Ukrit Siriprusanan of Geo Engineering & Testing.

This report details the feasibility and pre-design assessments of the Santos Memorial Park project site. These objectives are expected to be completed through the following tasks:

1. Site Investigation and Preliminary Engineering

- a. Field reconnaissance of the project site to confirm the proposed extent of improvements.
 - b. Study existing facilities, infrastructure, and storm water management features.
 - c. Computer plotting of the approximate location of known structures, landmarks, natural features, rights-of-way, and waterways within the project site.
 - d. Develop preliminary site improvement plans to clarify the scope of design for each phase of the project.
 - e. Identify any constraining factors that may adversely affect or hinder construction of improvements.
2. Environmental investigation by DBCA.
3. Archaeological Assessment by MARS.
4. Preliminary Design
- a. Analyze and develop alternative storm water management systems, including the use of recommended best management practices and innovative solutions for collection, treatment and disposal, which can be incorporated into a sustainable design for the site.
 - b. Establish the layout of site improvements, facilities, signage, amenities and alignment of the water and wastewater utility service laterals and connections.
 - c. Conduct preliminary system design analysis and initial engineering calculations. This task will determine the size and configuration of system elements and provide supporting data for determining the feasibility of the proposed improvements.
 - d. Prepare preliminary budgetary cost estimates.
 - e. Prepare an Assessment and Development Feasibility Report and submit to DPW for review and approval.

III. STUDY METHODS

The archeological assessment consisted of the use of a backhoe for excavating test pits. The subsurface assessment of the test pits was aided by laboratory analysis of soil samples. The archaeological assessment report was to include the preparation of Research Design for review and approval by the Government of Guam, Department of Parks and Recreation, Historic Resources Division. The environmental assessment consisted of a pedestrian survey by DCA biologists to assess the site for environmental issues related to permitting and construction of proposed improvements. Upstream portions of the Masso River and the surrounding area around the Masso Reservoir were also investigated. Coordination with the Department of Agriculture's Forestry Division and the Division of Aquatic and Wildlife Resources (DAWR) were initiated to obtain information on two separate, on-going projects. TRMA was to provide conceptual design drawings for the renovation of the park.

Project Team Chronology

Mr. Mike Park and Mr. Phil Guerrero from DCA visited the Santos Memorial Park project site on November 26, 2008 to conduct an environmental assessment. Archeology staff conducted their assessments on December 1-2, 2008. Mr. Mark Ruth from TRMA completed and presented several design layouts during the progress meeting with the Bureau of Statistics and Plans on January 15, 2009. General Civil, Structural, Mechanical, and Electrical requirements related to the proposed park improvements were also discussed.

The first project status meeting occurred on January 15, 2009 between the project team and Ms. Vangie Lujan from the Bureau of Statistics and Plans, and Mr. Vicente Gumataotao, Mayor of Piti. The meeting was held to discuss the initial archeological assessment completed by MARS and review the conceptual design drawings created by TRMA.

The project team also planned their next efforts on assessing the upstream portion of Masso River, starting from the Santos Memorial Park up to the Masso Reservoir. Various strategies for mitigating soil erosion, including dredging and re-vegetation with native plant species are to be investigated.

A. Archeological Assessment

MARS conducted an archeological assessment by excavating 12 shallow trenches throughout the Santos Memorial Park project site. The depth of the trenches ranged from 1.14 – 2 m. No cultural properties were encountered in the trenches. The complete archaeological report is attached in **Appendix A**.

B. Environmental Investigations

DCA conducted environmental field investigations at the project site and gathered information on relevant outside projects from the Guam Department of Agriculture Division of Forestry, and the Division of Aquatic & Wildlife Resources (DAWR).

Two ongoing projects were discovered to impact the proposed scope of work for the Santos Memorial Park. One project is the rehabilitation of Masso Reservoir, which is under the supervision of DAWR. The second project is the re-vegetation efforts of the Cetti Bay Watershed by the Guam Department of Forestry.

C. Architectural and Conceptual Design

Mr. Mark Ruth of TRMA produced several conceptual designs for Santos Memorial Park. The design layouts are attached in **Appendix B**.

IV. DISCUSSION OF FINDINGS

A. Archaeological Assessment

A total of twelve trenches were excavated by backhoe between the dates of December 1 and 2, 2008. The results of the subsurface assessment were published in the report, *Archaeological Testing at Santos Memorial Park. Piti, Guam* (Moore 2008). Throughout most of the area there is a layer of introduced fill below the topsoil. In the majority of the trenches, the fill consisted of quarried limestone gravel base course. However, on the west side of the park the introduced fill consists of material (i.e., sand and coral) dredged from the reef flat.

With exception to a few pottery sherds of an undetermined date discovered along the shoreline, little evidence suggests that the Santos Memorial Park area was once utilized during prehistoric times. While the backhoe testing found no significant historic properties, the following recommendations for further archeological work is provided:

1. The proposed park renovations should be designed so that areas below the layers of introduced fill material are not disturbed. In general, the top two feet layer of the project site consist of fill material and appears to be a good base for a potential parking lot, playground, sidewalk, and other improvements.

2. There is no fill material in the area by the beach pavilion and towards the river. Land alterations in this vicinity should be monitored by an archaeologist, or left undisturbed.
3. Any future trenching or excavation should be monitored by an archaeologist.
4. The concrete slab of the former basketball court may be demolished and the construction of a larger structure in its place is not expected to impact significant cultural properties.

History of the Santos Memorial Park site

In 1901, Guam became a territory of the United States as a result of the Spanish- American War. At that time, the Piti shoreline was one of only two landing sites on Guam for sea vessels. In 1933, the Agana-Tepungan channel was dredged to widen and deepen the passageway. It is possible that some of the dredged material from that project was placed on the nearby Piti shoreline, within the vicinity of the present day Santos Memorial Park (Moore, 2008). The Navy also built a causeway between the Piti shoreline and Cabras Island.

After World War II, the Agana-Piti Road was renamed to Marine Drive, in reference to the U.S. Marines who recaptured Guam. The Santos Memorial Park project site lies between this road and the Piti shoreline. The U.S. military also established a recreational beach at Hoover Park, located west of the project site, and attempted to use the project site for stockpiling metal pipes. It appears that much of the fill material discovered at the project site was introduced at this time to create a level surface for a future storage area (Moore 2008)

B. Environmental Investigations

Geology and Soils

The project site sits entirely on a quaternary red bluff formation (Geologic abbreviation Qrb) which was formed during the Pleistocene era. The entrance into Apra Harbor on the project site's southwestern side is composed completely of artificial fill (Geologic abbreviation. Qaf).

The predominant soil type at the project site consists of the Urban land-Ustorthents complex. This soil type often appears in coastal fill areas. Permeability is moderately rapid, runoff is slow, and the hazard of water erosion is slight. In addition, small areas along the shoreline contain Shioya

soil types, which are composed of water deposited coral sands derived from the reef. Permeability of the Shioya soil is rapid.

Soil Erosion

Soil erosion is caused primarily by road construction, brush fires, and feral ungulates. These events remove the vegetation layer and expose the topsoil. Reforestation of these affected areas would protect the topsoil and reduce excessive sediment loads from entering the ocean, thereby improving water quality. Two chief environmental concerns are the shoreline erosion caused by the ocean waves and the deposition of sediments by the Masso River into Piti Bay.

One possible solution to the shoreline erosion is reinforcing the shoreline with materials such as boulders and rocks, which would absorb most of the physical energy carried by the ocean waves. However, construction activities along Guam's shorelines require authorization from the Guam Seashore Protection Commission (GSPC). The permit process may take up to 6 months for an approval. Other approvals, such as a Department of the Army Permit from the U.S. Army Corps of Engineers (USACOE), may also be necessary.

Sedimentation occurs when the topsoil layer is eroded and carried into nearby rivers and reservoirs. High intensity rain storms will increase the velocity of river flow, which in turn can scour the river bed and river banks. Re-vegetation of the steep riverbanks and the barren areas around Masso River are one possible long-term solution to control soil erosion. Erosion mats can be used in combination with planting trees to provide short-term control of soil erosion.

Another possible solution involves dredging the Masso Reservoir, which has accumulated sediment and sludge over the years. Dredging would reduce the amount of available sediment that is carried downstream by the Masso River. Dredging activities are regulated under Section 404 of the Clean Water Act and require a Department of the Army Permit from the USACOE.

Threatened and Endangered Species

No threatened or endangered plant and animal species were observed at the Santos Memorial Park project site. Vegetation is especially dense at the southwest side along the riverbanks of Masso River with tangantangan (*Leucaena leucocephala*) and pako (*Hibiscus tiliaceus*). Several ironwood (*Casuarina equisetifolia*) and coconut trees (*Cocos nucifera*) are along the shoreline and were previously planted as a shoreline erosion control measure (Figure 2). However, the northwest side of the beach front has visible signs of shoreline erosion despite the presence of turf grass (Figure 3). Currently, the

eroding edge has a vertical drop of 50–80 cm to the beach, which becomes completely inundated during high tide.

Flood Hazard Classification

Flood hazard classification for the proposed project site was determined from the FEMA Flood Insurance Rate Map (FIRM) (Figure 4). Santos Memorial Park is designated as a high risk area with a Flood Zone VE designation, which are for coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage.

Reforestation of Cetti Bay Watershed and the Rehabilitation of Masso Reservoir

Two on-going projects by the Department of Agriculture's Forestry Division and the Division of Aquatic and Wildlife Resources (DAWR) have direct impacts to the Santos Memorial Park area. One project is the reforestation of the Cetti Bay Watershed and surrounding areas, the second is the rehabilitation of the Masso Reservoir. Both projects have tasks which mitigate the potential for soil erosion.

Reforestation of the Cetti Bay Watershed

The Department of the Navy completed a Final Environmental Impact Statement (FEIS) on the potential consequences of the proposed Kilo Wharf extension at the Apra Harbor Naval Complex, which is located south of the Santos Memorial Park (Federal Register 2007). The preferred alternative is to extend Kilo Wharf, which is used as an ammunition wharf, by 400 feet (i.e., 122 meters) to the west. The preferred alternative had a smaller ecological impact when compared to the other proposed alternatives. The preferred alternative will impact approximately 4.75 acres of benthic habitat, with 0.39 acres of it representing high density coral cover. Because the preferred alternative will result in unavoidable adverse environmental impacts, primarily to the marine environment, the Navy will also fund or implement compensatory mitigation to provide substitute resources or environments for those ecological services expected to be lost.

A Department of the Army permit is required for the preferred alternative since there is an alteration of navigable waters and discharge of fill material into the water. The USACE permit is the vehicle through which compensatory mitigation would be implemented. The Navy has coordinated with the resource agencies to develop a Mitigation Plan to satisfactorily meet the USACE permit requirements.

The mitigation plan is for the reforestation of the Cetti Watershed, located approximately 9 miles (14.4 kilometers) south of Apra Harbor. It was proposed by GOVGUAM based on habitat equivalency analysis (i.e., identifying lost ecological services to be replaced). Although there is no direct correlation between the number of lost acre years of coral and number of acres to be reforested as compensatory mitigation, a mutual consensus was reached between Navy and GOVGUAM that the Cetti Bay watershed reforestation project will consist of reforestation of up to 500 ac (202 ha) of savanna grasslands and/or badlands within the Cetti Bay watershed (Federal Register 2007).

In addition, the U.S. Navy has been partially funding reforestation efforts by the Department of Agriculture's Forestry Division for the riverbanks of the Masso River and the hill slopes near the Masso Reservoir. The typical tree species for soil erosion control are the ironwood tree (*Casuarina equisetifolia*) and the confusa tree (*Acacia confusa*). Tree seedlings for these species have been recently prepared at the Department of Agriculture's nursery and are expected to be mature enough to be transplanted to the project site by July 2009.

Masso Reservoir Rehabilitation

The proposed rehabilitation of Masso Reservoir would consist of dredging the Masso Reservoir, constructing a perimeter fence to keep ungulates out, and constructing a fishing platform on the west end of the reservoir. For the dredging operation, a portion of the vegetation on the periphery of the reservoir would be cleared to allow the excavators to pass through. The Masso Reservoir would be dredged up to the 55-foot elevation contour (Figure 5). In addition, reforestation of the upstream portion of the Masso River and upland areas will be done by the Department of Agriculture's Forestry Division. Necessary federal and local permits for these proposed actions have been secured, and construction is slated to begin in March 2009. It is anticipated that dredging the Masso Reservoir would remove a significant amounts of fine sediment particles which have settled at the bottom of the reservoir over time.

The Masso Reservoir was constructed in the 1945 by damming the Masso River. The reservoir was originally intended for the storage of drinking water, but was subsequently abandoned in 1951 because of excessive siltation. A dike and concrete spillway, approximately 65 m long, was built on the west bank of the reservoir. Water depth of the reservoir is about 13 feet and falls slightly during the dry season (Biosystems Analysis, Inc. 1989). The reservoir's watershed covers approximately 494 acres of predominantly undeveloped land and hilltops.

In 1978, The Division of Aquatic and Wildlife Resources (DAWR) renovated the Masso Reservoir with the goal of transforming it into a public park and fishing area. DAWR removed about 2.5 acres of *Phragmites*, repaired the spillway, and planted exotic trees and shrubs on the riverbanks. In 1980 and 1981, DAWR stocked the reservoir with hybrid tilapia (*Oreochromis mossambicus* x *O.niloticus*), mosquito fish (*Gambusia affinis*) and tucunare (*Cichla ocellaris*) (Hosmer 1982). However, vandalism and illegal fishing caused the management program to be terminated in 1983 (Molina 1983).

The dominant vegetation within the Masso Reservoir wetlands are pure stands of *Phragmites karka*, along with the less prevalent *Bambusa vulgaris*. The Common Moorhen (*Gallinula chloropus guami*) has been occasionally seen near the reservoir. Further observations may find that moorhen nesting occurs there (Personal communication, Mr. Brent Tibbatts, Fisheries Biologist, DAWR, January 30,2008).

The Masso River flows downstream from the Masso Reservoir and passes underneath Route 6 through culverts, and continues downhill underneath two bridges on Assumption Drive and Route 1 respectively, before finally entering Santos Memorial Park and out into Piti Bay. Both bridge underpasses have recently been reinforced with concrete and riprap in 2008 by the Department of Public Works.

V. BASIS OF DESIGN

A. Architectural Basis of Design for the Santos Memorial Park

1. Design References
 - a. Uniform Building Code (UBC), 1994 Edition
 - b. Americans With Disabilities Act Accessibility Guidelines
2. Scope of Architectural Work
 - a. Site Planning
 - b. Park Gate and Signage
 - c. Pavilions
 - d. Restroom Renovation
 - e. Memorial Plaque
 - f. Site Furniture
 - g. Landscaping
3. Description of Planning

- a. The scope of this phase includes the existing park area south of the Maseo River and back from the 35-foot public way setback from the ocean shoreline. The area within the 35-foot reserve and north of the Maseo River will be undertaken as a future phase.
- b. Ten site development plan options were presented January 16, 2009 and based on comments of the participants, they were revised and three options were presented January 30, 2009. Elements of options 1 and 3 were then combined into the final preferred alternative.
- c. The preferred alternative locates a central pavilion with two smaller flanking pavilions south of the existing basketball concrete slab. This slab will be incorporated as a multi-use pad to accommodate a variety of park and village uses. Parking is located to the east, near the small creek. The green area to the west will be used as a playground and for overflow parking should it be needed. A memorial plaque will be located between the parking area and the center pavilion.
- d. Due to flood zone restrictions, the pavilions will be open without walls or other elements which would restrict wave velocity. The existing restroom facility will be upgraded in place without any increase in its footprint or addition of walls. Existing columns near the river will be provided with a new trellis "open-roof".
- e. The park will be encircled with a paved walking/running path extending along the shoreline reserve, river, and to the existing picnic pavilion in the southwest corner of the site. Stretching pads, concrete benches and other amenities will be located along the walkway.
- f. A new lockable entrance gate will be provided. The park identification sign will be incorporated in the gate.

4. Description of Architectural Design

- a. The central pavilion is comprised of the 1, 000 square foot main pavilion and two smaller pavilions of 300 square foot each. The three pavilions are interconnected by a concrete trellis and face onto the existing multi-use concrete pad. The open sided pavilions have hip-style roofs supported by concrete columns.

- b. A previous pavilion near the mouth of the Maseo River will also be provided with new concrete trellis members on existing concrete columns.
- c. The existing restroom building will be renovated with new fixtures, washroom accessories, doors, hardware, windows and paint. The facility will be connected to the existing sewer.
- d. Park furniture including waste containers, benches and tables will be located strategically along the walking/running path.
- e. The existing pavilion near where the Maseo River bridge on Marine Drive will be repaired and repainted.
- f. Due to the corrosive environment near the lagoon, materials will be primarily concrete, stone and ceramic tile. Where metals are used, they will be either aluminum or stainless steel. Other than where natural materials such as stone are used, all structures will be painted including existing structures.
- g. Landscaping will be include large grassed lawns and play areas. Existing trees will be preserved with the exception of those which are in damaged or poor health. New trees and shrubs will be provided at strategic locations. The rivers shoreline will be trimmed and thinned as necessary to develop views and access. In addition to non-invasive and salt tolerant plants, the ornamental Piti village flower – Plumeria Obtusa (known as White Plumeria, Frangipani, or Kalachuchi) will be used.

B. Civil Basis of Design for the Santos Memorial Park

1. General Site Improvements

- a. Walkways and Pathways - Currently, the site does not have walkways connecting the existing structures/amenities in the park. The new improvements will install meandering walkways, approximately 5 feet wide, that will connect these existing and proposed new structures/amenities in the park. These walkways can also be used by joggers/walkers that use the parks. Walkways

will be designed and constructed following closely the existing topography to minimize cost for earthworks.

- b. Access Road and Parking Lot – New asphalt paved access road and parking is being planned for the park. The pavement structure will likely comprised of 6" thick compacted basecourse and 2" thick asphalt pavement. The parking lot will be able to accommodate approximately 20 vehicles. Reserved spaces for people with disabilities, with appropriate signs, will be provided. On large events or gatherings, overflow parking can utilize grassed or open areas within the park. Main entrance to the park will be provided with lockable gate.

2. Drainage Improvements

- a. Storm Drainage Disposal – Storm drainage disposal will be handled "on-site" by means of strategically located localized and shallow depressions. It is not anticipated that underground drainage lines, drainage structures, and underground stormwater disposal system will be needed.

3. Utilities (Water and Sewer) Improvements

- a. Water System – There is existing restroom building at the site and it is assumed that it has already a water supply from the Guam Waterworks Authority's (GWA) water main on Marine Corps Drive. It is not anticipated that a new water supply lines will be needed. However, the existing waterline will have to be retrofitted with a backflow preventer device to comply with current GWA's policy. If new water outlets are required or needed in other parts or portion of the park, these can be connected to the existing water line currently supplying the park.
- b. Sewer System – The existing restroom building at the site appeared to be utilizing septic tank and leaching field for wastewater disposal. It is anticipated that GWA and Guam EPA will require this restroom to be connected to the sewer system. There is existing sewer system on Marine Corps Drive and appeared suitable for receiving a new connection for a service lateral from the park.

C. Structural Basis of Design for the Santos Memorial Park

1. General Structural Improvements

The purpose of this project is to provide improvements to the existing Santos Memorial Park located in Piti, Guam. The improvements consist of the repair and/or replacement of existing shelter and bathroom facilities, a new Pavilion and miscellaneous structures, park benches, new parking with drainage provisions, site paths, and parking lighting.

2. Project Location

The project is located at Piti, Guam.

3. Scope of Design Buildings

The central pavilion is comprised of the 1, 000 square foot main pavilion and two smaller pavilions of 300 square foot each. The three pavilions are interconnected by a concrete trellis and face onto the existing multi-use concrete pad. The open sided pavilions have hip-style roofs supported by concrete columns. The pavilion construction will be of reinforced concrete and designed for wave action, seismic zone 4 requirements, and for wind speeds of 175 MPH.

The deteriorated roof of the existing pavilion near the mouth of the Maseo River will be removed and provided with new reinforced concrete trellis members attached to the existing concrete columns.

4. Design Criteria and Assumptions

CODE

1994 UNIFORM BUILDING CODE

WIND FORCE

WIND VELOCITY 175 MPH

WIND PRESSURE (basic) 78.4 PSF

EXPOSURE D

IMPORTANCE FACTOR = 1.0

SEISMIC FORCE (Seismic Zone 4)

$V = ZICW/R_W$

$Z = .40$

$I = 1.0$

$C = 2.75$ (max)

$R_W = 6$

$W = \text{ACTUAL}$

REINFORCED CONCRETE

FOOTINGS $f'c = 3,000$ psi

SLAB ON GRADE $f'c = 3,000$ psi

OTHERS $f'c = 4,000$ psi

REINFORCING STEEL $f_y = 60,000$ psi

LOAD COMBINATIONS FOR MASONRY

DEAD LOAD + LIVE LOAD = 100%

DEAD LOAD + LIVE LOAD + WIND (EARTHQUAKE) = 133%

CONCRETE STRENGTH DESIGN

1.4D + 1.7L

.75D (1.4D + 1.7L + 1.7W)

1.4 (D + L + E)

.9D + 1.3W

.9D + 1.4E

D = DEAD LOAD

L = LIVE LOAD

W = WIND LOAD

E = EARTHQUAKE

CONCRETE COVERING

TOP OF SLAB 1½"

BOTTOM OF SLAB 1"

SIDES OF BEAMS 2"

COLUMNS 2"

WALL EXPOSED TO EARTH OR WEATHER 2"

FORMED FOOTINGS 2"

FOOTINGS CAST AGAINST EARTH 3"

ALLOWABLE SOIL BEARING PRESSURE

DL + LL

DL + LL + E (W)

4000 psf (Assumed)

6000 psf (Assumed)

STRUCTURAL STEEL

SHAPES AND PLATES ASTM A36

TUBES AND PIPES ASTM

A500B

BOLTS AND NUTS ASTM A325

ANCHOR BOLTS ASTM A325

WELDING ELECTRODE E70XX

D. Mechanical Basis of Design for the Santos Memorial Park

1. Project Purpose

This project is intended to provide for the necessary improvements and repairs at the existing Santos Memorial Park in Piti, Guam. The mechanical design will encompass the renovation of existing restroom facilities to restore functionality and provide for necessary public facilities to re-open the park.

2. Design References

The following references were used in the development of this design:

- a. Uniform Building Code

- b. Uniform Plumbing Code
 - c. Uniform Mechanical Code
3. Contract Requirements
- The contract under which this design was conducted requires:
- a. Analysis of applicable code requirements;
 - b. Design of necessary improvements to plumbing systems
4. Existing Conditions:
- The project site is currently closed for use by the Piti Mayor's office, which maintains ownership and control of the facility. Preliminary condition assessments were developed during the mechanical inspection conducted as part of preliminary design activities.
- The existing restrooms are connected to an old on-site sewage disposal (septic) system. There are existing fixtures within the two separate men's and women's restrooms. Each restroom is equipped with lavatory, water closet(s), and floor drains. In addition, the men's room is equipped with a single urinal. The urinal and water closets utilize flush-valves. There are also shower heads and valves (cold water only) located at the exterior of the restrooms. Existing water service piping appears to be galvanized steel. The condition of existing fixtures and valves are generally poor. The restrooms are equipped with natural ventilation via breeze-block openings in the existing concrete structure.
5. Scope of Improvements
- This project involves the construction and /or installation of the following improvements:
- a. Installation of new lavatories, angle valves and faucets with trim.
 - b. Installation of new urinal and flush valve.
 - c. Installation of new water closets and flush valves.
 - d. Installation of new shower heads and faucets.
 - e. Repair or replacement of floor drains in each restroom.
 - f. Connection of existing sewer drain piping to sanitary sewer system (see Civil Basis of Design for additional detail on site utility piping systems).
 - g. Replacement of existing building water service piping with new piping (PVC Schedule 80).

Design Basis

Plumbing Systems: The existing restrooms have been sized for the anticipated occupancy/park patron numbers. As this is a replacement in kind, there are no new fixtures being added or deleted.

1. Men's Room: Design will be based on providing vitreous china, vandalism-resistant fixtures and trim. Fixtures and piping will be installed as follows:
 - a. Lavatory: 1 each
 - b. Urinal: 1 each
 - c. Water closets: 2 each
 - d. Floor drain: 1 each
2. Women's Room:
 - a. Lavatory: 1 each
 - b. Water closets: 2 each
 - c. Floor drain: 1 each
3. Exterior showers:
 - a. Shower heads/faucets: 2 each
4. Sewer piping:
 - a. 4-inch diameter PVC DWV type piping will be installed to within 5-ft of the building. New piping will be installed to nearest sanitary sewer connection based on the Civil Basis of Design.
5. Water Piping:
 - a. New water piping will be sized appropriately for the fixtures to be served. Water piping shall be PVC Schedule 80.

E. Electrical Basis of Design for the Santos Memorial Park

Design References:

Government Criteria and Standards:

Department of Public Work Standards, Government of Guam – DPW
Guam Fire Department Standards, Government of Guam – GFD
Guam Power Authority Standards, Government of Guam – GPA

National Codes and Regulations:

NFPA 70, National Electrical Code, 2008
NFPA 72, National Fire Alarm Code, latest edition
NFPA 101, Life Safety Code, 2006 edition
American with Disabilities Act Guidelines – ADAG
OSHA Regulations
International Building Code – IBC

Special Considerations:

Wind Loading – 175 MPH, sustained
Seismic Zone 4
Corrosive Environment

Scope of Electrical Work:

Electrical Service and Distribution System

Lighting System:

Building lights
Area lighting
Sign lighting
Provisions for walkway lighting.

Description of Electrical Work:

Electrical Service and Distribution System:

New electrical service shall be coordinated with GPA. The facility may be served from a new GPA pole mounted transformer installed at the nearest GPA concrete power pole. A kilowatt-hour meter conforming to GPA standards shall be provided.

Lighting System:

Energy efficient lighting shall be used throughout the facility. Building lights shall be T8 fluorescent lamps or compact fluorescent. Area lighting shall be metal halide. Electronic ballast shall be provided for all fluorescent light fixtures. Metal halide light fixtures shall be energy efficient and equipped with high power factor ballast.

Buildings:

Provide new energy efficient lighting at the restrooms and pavilions.

Area Lighting:

- a) Parking lot:
Metal halide light fixtures mounted on 20 ft. high aluminum light pole.
Duplex outlet shall be provided at the bottom each pole
Signs shall be provided with adjustable ground mounted floodlights.
- b) Walkway lighting:
Bollard lighting shall be provided along the length of the walkways if budget permits.

Lighting Control:

Building lights shall be provided with manual local control. Exterior and sign lighting shall be automatically controlled by photocell.

Fire Alarm System:

Fire alarm system is not required.

Telephone System:

Conduit for telephone system is not required.

Cable TV:

Conduit for cable TV is not required.

Security System:

Security System is not required.

Public Address System:

Public Address system is not required.

H. Geotechnical Investigation for the Santos Memorial Park

Geotechnical work is pending and will commence once the GEPA digging permit is obtained. Assumed foundations for the new pavilions will be individual column spread footing with tie/ grade beams. Alternate mat slab foundations would also like be considered for the building support. Imported structural subgrade would likely be required under the foundations.

VI. CONSTRUCTION BUDGET

Estimated costs for the Phase 1 & 2 improvement to the Santos Memorial Park Follows:

ARCHITECTURAL/STRUCTURAL:

Restroom Restoration	\$ 25,000
Central Pavilion and Pergola	\$ 120,000
Paint and Repair Existing Pavilions	\$ 6,000
Memorial Plaque	\$ 4,000
Entrance Gate and Park Sign	\$ 6,000
Miscellaneous Signage	\$ 3,000
Benches	\$ 12,000*
Waste Containers	\$ 9,000*
Landscaping (Clean/Develop River Bank)	\$ 50,000

<u>CIVIL</u>	\$ 200,000*
<u>ELECTRICAL</u>	\$ 85,000
<u>MECHANICAL</u>	<u>\$ 15,000</u>
TOTAL	\$ 535,000

***Note:**

Items noted with asterisks may be considered as optional bid items. These items may also be reduced in scope to meet construction budget.

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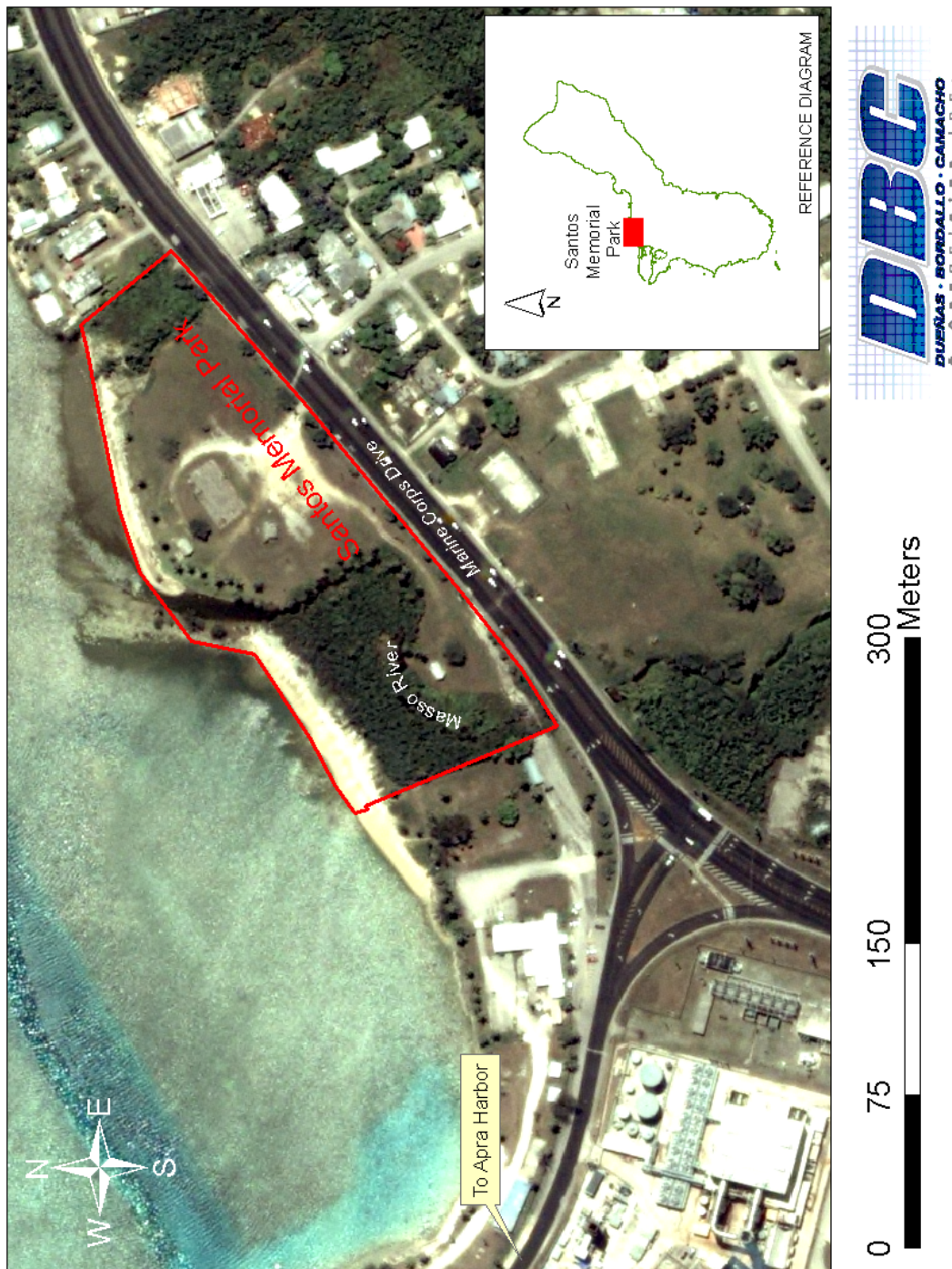


Figure 1. Vicinity map of the Santos Memorial Park, Municipality of Piti, Guam.



Figure 2. Shrubs and Coconut trees planted for shoreline erosion control.



Figure 3. Evidence of shoreline erosion on the west side of the Santos Memorial Park.

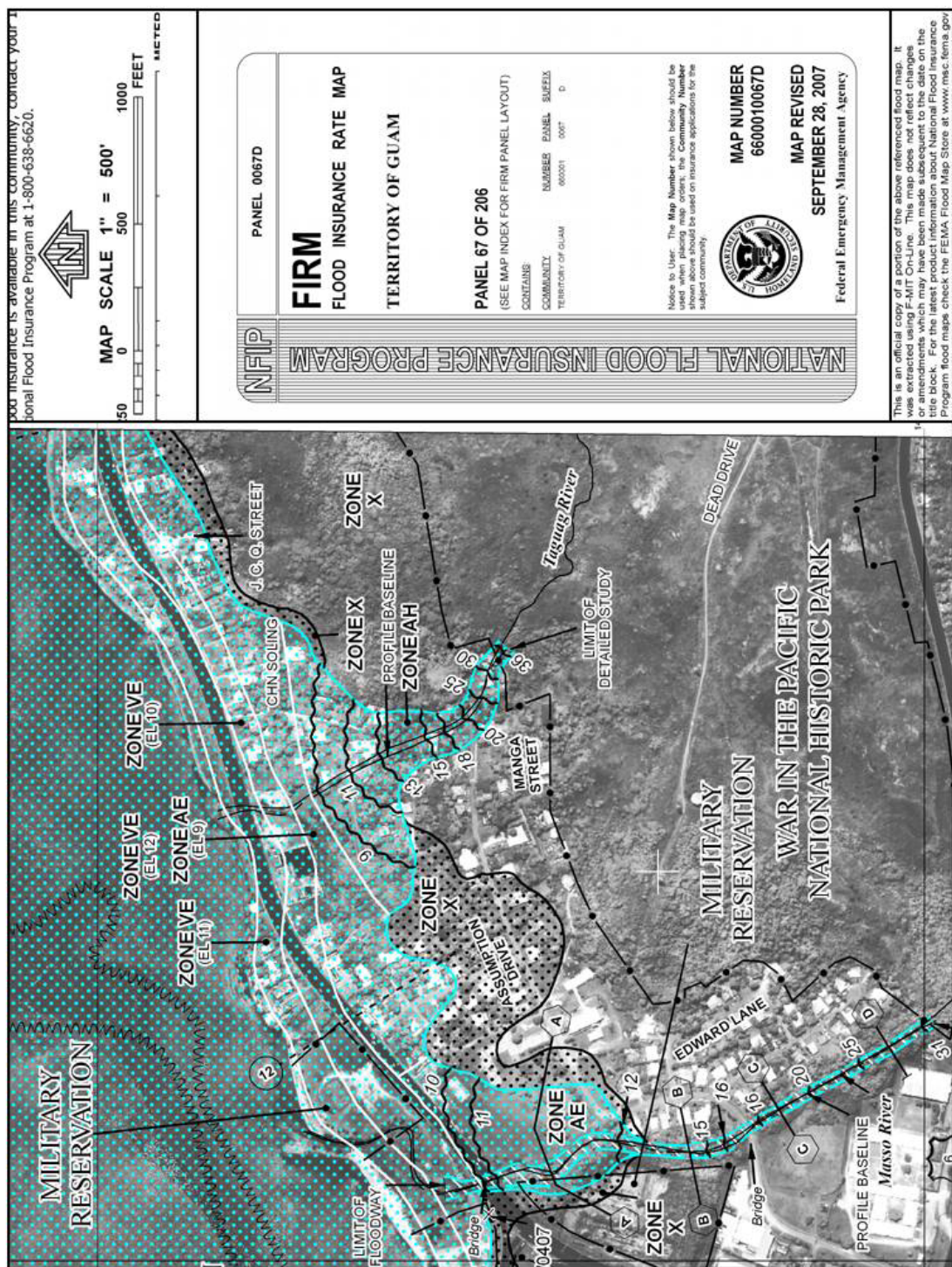




Figure 5. Map illustrating extent of proposed dredging at Masso Reservoir.

APPENDIX A

ARCHAEOLOGICAL ASSESSMENT REPORT



ARCHAEOLOGICAL TESTING AT
SANTOS MEMORIAL PARK
PITI, GUAM

by

DARLENE R. MOORE

and

JUDITH R. AMESBURY

MICRONESIAN ARCHAEOLOGICAL RESEARCH SERVICES

2009



ARCHAEOLOGICAL TESTING AT
SANTOS MEMORIAL PARK
PITI, GUAM

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Prepared for

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January 2009

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TABLE OF CONTENTS

	Page
Acknowledgments.....	i
List of Tables	iii
List of Figures	iii
List of Photos	iii
Introduction.....	1
Research Objectives.....	3
Research Methods.....	3
Significance Criteria	3
Environmental Background	5
The Environment of Santos Memorial Park	6
Cultural Historical Background	6
Spanish Period	7
First American Period	7
Japanese Occupation/World War II	7
Second American Period.....	8
History of the Piti Area	8
Archaeological Background.....	15
Archaeological Expectations for the Project Area.....	16
Research Questions.....	16
Letter Report	16
Technical Report.....	16
MARS Qualifications.....	17
Disposition of Artifacts and Samples	17
Results of Field Work	17
Results of Laboratory Analyses	30
Ceramics, Historic.....	30
Ceramics, Traditional.....	32
Faunal Remains.....	33
Marine Mollusks	33
Other Invertebrates.....	34
Vertebrates	34
Glass.....	34
Lithics	34
Metal	36
Wood Identification	36
Summary and Discussion.....	36
Recommendations.....	37
References Cited	38
Appendix A, Field Catalog	41
Appendix B, Wood Identification.....	43

LIST OF TABLES

	Page
1. Pertinent information regarding the Backhoe Trenches by number	20
2. Historic ceramics recovered from the project area	31
3. Count and weight of pottery sherds by backhoe trench and catalog number	32
4. Characteristics of the seven traditional sherds by trench and catalog number	33

LIST OF FIGURES

1. Section of the USGS Apra Harbor Quadrangle (2000) map showing the location of Santos Memorial Park	2
2. Preliminary sketch of the proposed improvements at Santos Memorial Park	4
3. The Mariana Islands, showing the location of Guam	5
4. Hornbostel's map of Guam made in the 1920s showing the distribution of latte sets on the island at the time	9
5. Section of a map of the Harbor of San Luis D'Apra prepared in 1901 showing the Piti vicinity	10
6. Section of a map of Guam showing the place names, roads, trails, and fields in the vicinity of Piti	12
7. Section of a map of Guam showing the Piti shoreline, the Navy Yard, the dam on the Masso River, and the structures on the beach on either side of the Masso River mouth	13
8. A portion of the Area Allocations Map dated October 1945 showing how parts of Guam were being utilized by the US military	14
9. Plan of Santos Memorial Park showing the locations of Backhoe Trenches 1-12	18
10. West face of BT 1	22
11. East face of BT 5	24
12. West face of BT 6	25
13. East face of BT 9	28

LIST OF PHOTOGRAPHS

1. View of Santos Memorial Park	2
2. View of Santos Memorial Park's eroding shoreline and beach deposit	19
3. View of the Masso River mouth	19
4. View of the east side of the project area	22
5. BT 1, west face	23
6. BT 2 showing the south end of the trench	23
7. View of the west side of the project area	26
8. BT 8, west face	26
9. View of the east face of BT 9	27
10. Stoneware rice bowl from BT 9	31
11. Historic ceramic fragments	32
12. Slab of green tuffaceous sandstone from BT 1	35

INTRODUCTION

Duenas, Bordallo, Camacho, and Associates, Inc. (DBCA), contracted Micronesian Archaeological Research Services, Inc. (MARS) to provide archaeological services for the proposed improvements to Santos Memorial Park (SMP), Piti. MARS discussed the project with Vic April, Archaeologist, Guam Historic Preservation Office (HPO). It was decided that prior to implementing the renovations at the park, an archaeological testing program should be completed. On December 1-2, 2008 a small Case backhoe, under the direction of MARS, dug 12 archaeological test trenches across the Phase 1-2 project area in order to determine if significant intact cultural deposits were present. None was found.

The SMP is located on a 6.5 acre parcel of land, Lot 262, along the shoreline in Piti on either side of the mouth of the Masso River (Fig. 1). The river flows through the project area dividing it into two parts (Fig. 2). The shoreline forms the park's northwestern boundary and Marine Corps Drive forms the park's southeastern boundary. The Piti Cable Landing Site is located to the east and Hoover Park (United Seamen's Service) is located to the west. Currently two concrete picnic pavilions, a concrete restroom facility, and a paved basketball court exist within the park boundaries (Photo 1). The ground surface within the project area includes gravel, backfill, and a shallow deposit of humic topsoil. Vegetation includes mown grasses and weeds, dense grasses along the edges of the river, and various shrubs and trees including pandanus, pigo (*Hibiscus tilaceus*), coconuts, ironwood, tangen-tangan, legumes, and plumeria.

As shown on Fig. 2, the proposed improvements to the park include constructing additional picnic pavilions, a playground, pathways, jogging trails, a small foot bridge across the river, and a defined parking area. The existing restroom facilities will be upgraded and refurbished. In addition, lighting, a memorial plaque and signage will be installed and the area will be landscaped. The proposed work will be carried out in three phases. Phases 1 & 2 will be completed first and this area was the focus of the present archaeological testing program. Phase 3, on the west side of the Masso River, will take place sometime in the future, when additional funding is available.

The archaeological work is mandated by section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations (36 CFR Part 60, 36 CFR Part 800, and the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation). Section 106 and its implementing regulations define an undertaking as "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring federal permits, license or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a federal agency". The Section 106 process was implemented because the park improvements involve some federal funding provided by Housing and Urban Development (HUD).

The local regulatory mandate for the testing and assessment includes Guam Executive Orders 89-9 and 89-24, and Public Law No. 20-151. As required by the government of Guam, the U.S. Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation were followed during the investigations.

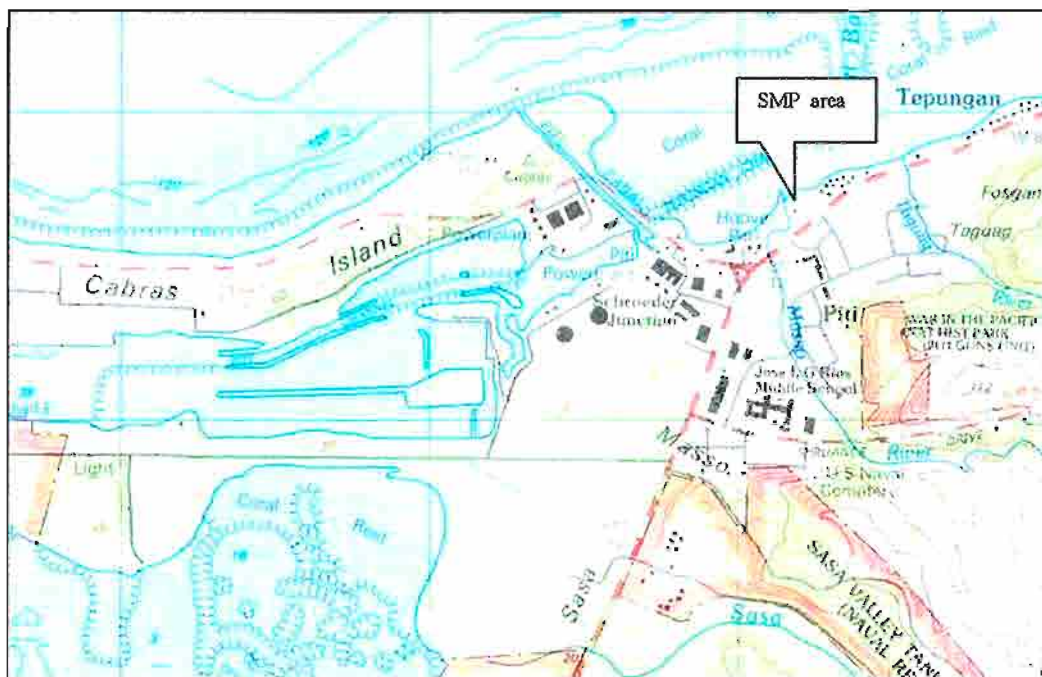


Figure 1. Section of the USGS Apra Harbor Quadrangle (2000) map showing the location of the Santos Memorial Park.



Photo 1. View of Santos Memorial Park showing the sparse vegetation, the basketball court (with the framework to suspend the missing hoops), a pavilion on the beach, and the restroom to the left. The camera is facing west; the power plant and Cabras Island are in the background.

RESEARCH OBJECTIVES

The primary objectives were to determine whether historically significant cultural materials occur in the project area, to assess and document them if they were encountered, and to recommend their appropriate treatment with respect to the proposed improvements planned for the park. In addition, the project findings will be integrated into existing archaeological and historical knowledge of the region; this knowledge includes the inventory of significant prehistoric and historic sites on Guam.

No significant cultural resources were found during the testing. Few prehistoric materials were observed and only a few historic items were seen and collected. This information is also useful. For the effective management of the island's cultural resources, it is important to know where archaeological deposits and features do not exist as well as where they do. In addition to management considerations, accurate characterization of the spatial and temporal distributions of artifacts and features is essential for Guam oriented research as well as archaeological research generally.

RESEARCH METHODS

In the field, MARS directed the backhoe operator to excavate 12 trenches on the property. The trenches were sized and placed so as to give an accurate representation of the subsurface contents of the project area. Each trench was documented. Representative trenches were drawn and photographed in order to show the stratigraphic context of the deposits exposed by the test trenching. A few artifacts were collected. No significant intact cultural deposits were encountered by the trenching.

SIGNIFICANCE CRITERIA

The U.S. National Register of Historic Places Criteria A-D (36 CFR Part 60.4) were applied to evaluate the historic significance of the cultural resources encountered during the testing. Criterion A states that the site must be associated with events that made significant contributions to broad patterns of our history; Criterion B states that it must be associated with the lives of persons significant in the past; Criterion C states that it must embody distinctive characteristics of a type, period, method of construction, or represent the work of a master, or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction; and Criterion D states that it must have yielded, or is likely to yield, information important to prehistory or history. Criterion D is often cited in assessing the significance of Guam's prehistoric sites while Criterion C has been cited in assessing the significance of some of Guam's historic sites.

Mortuary areas (places of human interment), which in the Marianas often occur in former residential areas are considered highly significant locally, and the Guam government prefers that they be avoided by construction. This requirement sometimes results in the redesign of a construction project. No burials were identified or disturbed by the subsurface testing.

Following the completion of the field work, laboratory analyses took place, followed by the preparation of this technical report that presents an environmental overview of the project area, describes the previous archaeological research in the vicinity of SMP, reviews the historic land-use activities in the vicinity of the project, and proposes the site types likely to exist in the

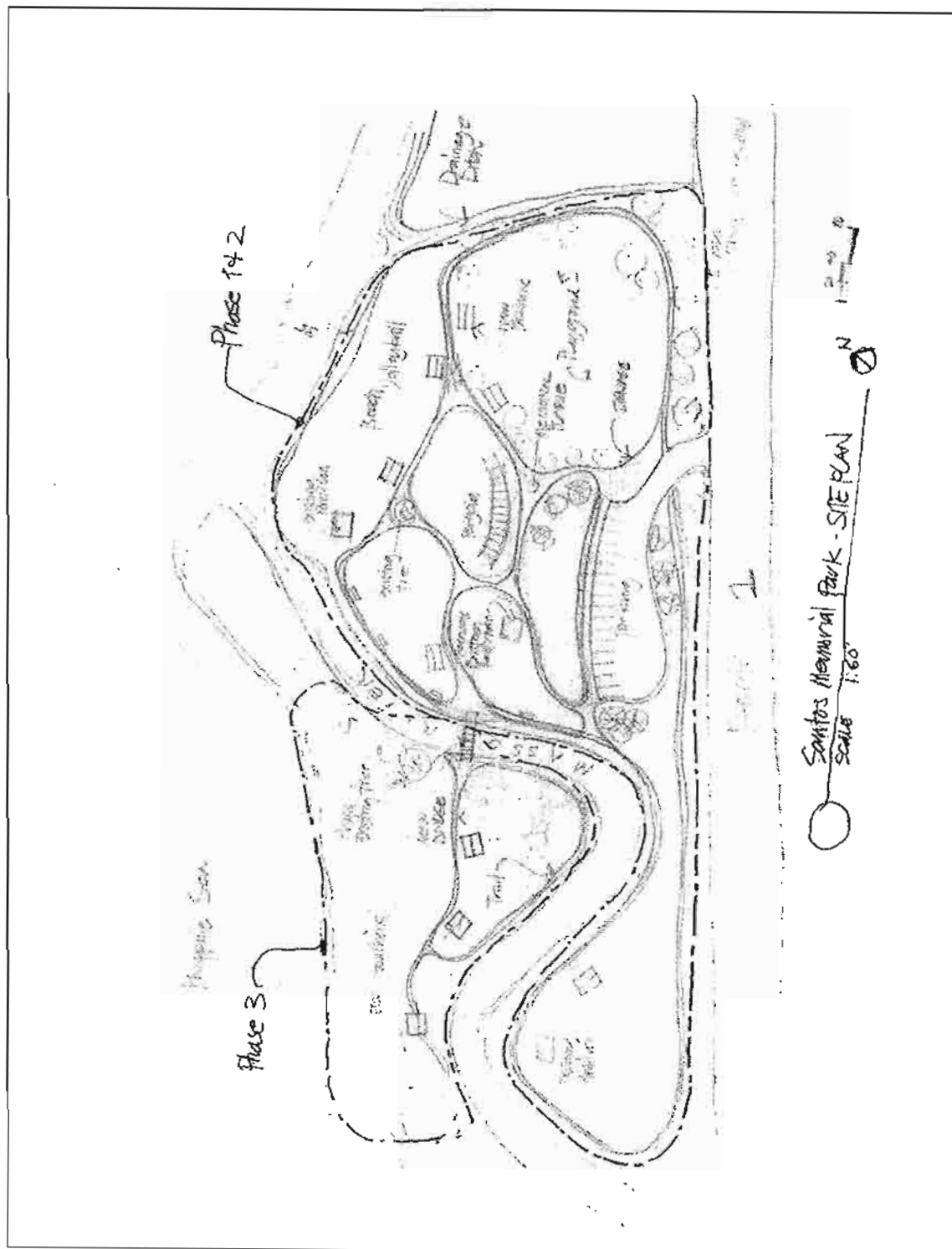


Figure 2. Preliminary sketch of the proposed improvements at Santos Memorial Park, after Duenas, Bordallo, Camacho and Assoc.

project area. It also presents the field and laboratory findings and assesses the significance of historic properties.

ENVIRONMENTAL BACKGROUND

The Mariana archipelago is a northeast/southwest-trending chain of islands. Distributed along two roughly parallel arcs, the islands extend from 13° to 21° north latitude. The younger island arc lies north and slightly west of the older arc. The older arc contains the four largest islands: Guam, Rota, Tinian, and Saipan (Fig. 3). While the larger islands have been studied archaeologically, little is known about the smaller northern islands (see Hunter-Anderson and Butler 1995; Russell 1998). Guam is the largest at 212 sq mi. Guam's long and complex geologic history has been described by Tracey et al. (1964).

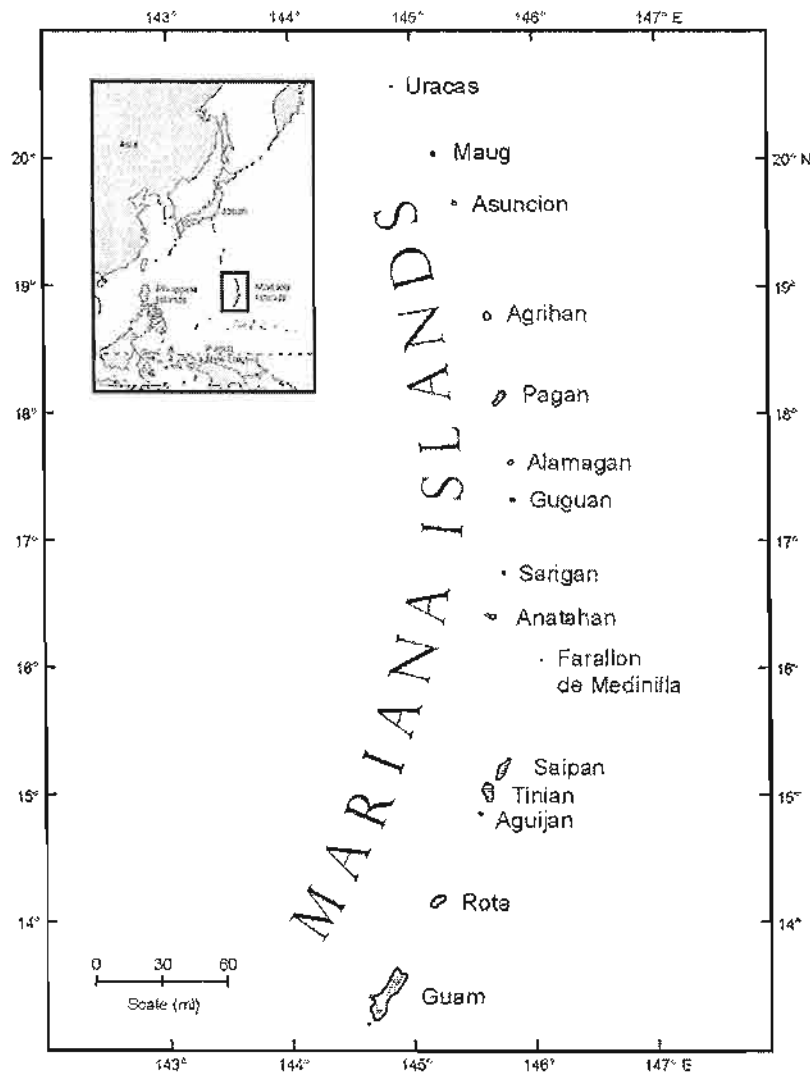


Figure 3. The Mariana Islands, showing the location of Guam. The inset shows the location of the Marianas in the Pacific. (Map courtesy of Barry Smith, University of Guam Marine Laboratory.)

The northern half of Guam is an uplifted limestone platform composed of an undulating karstic plateau with two major volcanic "inliers" (Tracey et al. 1964). The southern half of the island is composed of volcanic uplands dissected by numerous streams and small embayments. Due to the asymmetrical tilt of the southern highlands, drainages are short and steep on the southwest coast and longer and gradually sloping on the southeast coast. The reef-protected lagoons occur on the leeward west coast. The Piti reef flat is an example of a narrow leeward lagoon.

The Environment of Santos Memorial Park

Young (1988) describes the soils in the SMP project area as consisting of the Urban land-Ustorthents complex. This map unit occurs on coastal fill. Urban land consists of areas covered by buildings, roads, and parking lots. Some of these areas have a base of crushed coral, and some rest directly on limestone. Areas of urban land are impermeable to water and runoff is rapid. Ustorthents is quarried fill material. Commonly the fill is crushed coral gravel and cobbles and pockets of gravelly clay and clay loam. Permeability of Ustorthents is moderately rapid, runoff is slow and the hazard of water erosion is slight.

Included in this unit are small areas of Shioya soils along the shoreline. Shioya soils are made up of water deposited coral sands derived from the reef. Permeability of the Shioya soil is rapid. Shioya soils have been favored for habitation in the Marianas since early prehistoric times, and archaeological traces of prehistoric activities frequently are encountered in the portions of this soil unit that were stabilized. Due to recent construction activities, late prehistoric deposits lying close to the surface and fairly close to the present shoreline are often compromised by the introduction of modern debris and from biological and mechanical disturbances.

The seaward shoreline of the SMP project area is eroding and in places it has been undercut by the constant wave action. Currently the eroding edge of the shoreline has a vertical drop of 50-80 cm to the narrow beach, which is underwater during periods of high tide. The eroding edge of the sand flat consists of beach sand with abundant fragments of coral, rocks, bits of glass and unidentified pieces of metal. No traditional cultural material was seen on the beach. Naturally occurring marine shells on the beach include mangrove-associated bivalves such as *Anadara antiquata* and *Grafrarium tumidum*. These shells suggest that portions of the area may have formerly supported mangroves.

CULTURAL HISTORICAL BACKGROUND

Guam's cultural history may be divided into the Prehistoric Period beginning c. 3,500 years ago and the Historic Period that began in the 16th century. Generally the Prehistoric Period is divided into two phases, the Pre-Latte and the Latte. The Historic Period is divided into Spanish, First American, Japanese Occupation/World War II, and Second American Periods.

Marianas archaeologists recognize two broad Prehistoric (or pre-European Contact) cultural phases, the Pre-Latte and the Latte. The Pre-Latte Phase extends from initial human occupation of the Marianas about 3,500 years ago until about 1,000 years ago. Based on differences in the pottery, the Pre-Latte Phase can be divided into shorter temporal intervals such as the Early, Mid, and Late Pre-Latte (or Unai as it is sometimes called). The shift from the Unai

to the Latte Phase began around A.D. 800/900. The Latte Phase continued for about 700 years until the Spanish arrived in A.D. 1521.

The most prominent characteristic of the Latte Phase is the latte set, two rows of stone pillars and caps which served as a foundation for a wood and thatch structure. Latte sets occur in coastal and inland sites near water sources. Other important Latte Phase traits include large basalt mortars, ceramics, basalt ground stone tools, *Tridacna* shell adzes, *Isgnomon* shell fish hooks and gorges, slingstones, *Spondylus* shell beads, awls and spears made from human bone, and human interments within and near latte sets at coastal sites.

Spanish Period

The Spanish Period began in 1521, the year Magellan stopped in the islands during his attempt to sail around the world. In 1565 Legazpi claimed the Marianas for Spain. In 1668, the first Spanish Catholic mission and colony were established in Hagatna, followed by 30 years of intermittent warfare. By 1700, peace had been achieved and the Spanish resettled the remaining Chamorros in six villages. Each village had a church. Apparently the people living in the Tepungan area were relocated to Hatagna.

During the Manila Galleon era (c. 1565-1815), the Europeans introduced a variety of plants and animals to Guam. Among the plants were corn, sweet potatoes, rice (this grain had been grown prehistorically as well; see Hunter-Anderson et al. [1995] for archaeological evidence), coffee, and tobacco. Also incorporated into the evolving island culture were the Mexican *metate* and *mano* to process dried corn, the griddle (*kommot* in Chamorro; Topping et al. 1975) on which to cook the tortillas, the oven (*hotno*) to bake and roast, and a metal hoe to work the soil. Among the animals were deer and carabao from the Philippines, as well as cattle, horses, goats, pigs, turkeys and chickens.

The Spanish Period formally ended on Guam with the arrival of the Americans, who took over administration of the colony in 1898 as one of the spoils of the Spanish-American War.

First American Period

Under American administration, Guam had a series of naval governors headquartered in Hagatna. The naval administrations provided some employment for local residents, and thus began a wage economy, although most local people still raised their own food. Descriptions of the period appear in Thompson (1947), Safford (1910), and Nelson and Nelson (1992).

The new government organized agricultural programs designed to meet the needs of the American military personnel and their families. Other government projects included health programs, a public education system, piped water, and better roads. This four-decade-long early 20th century colonial interlude ended with the Japanese invasion of Guam in 1941. The Northern Marianas were already in Japanese hands as a League of Nations mandate as of 1914.

Japanese Occupation/World War II

Detailed descriptions of the Japanese Occupation, which coincided with U.S. entry and involvement in WWII may be found in Sanchez (1979, 1988). Japanese troops landed on the shores of East Agana Bay and Tumon Bay on the morning of Dec. 10, 1941. They made their

way to Hagatna, where, after a short battle, they captured the island and established administrative headquarters. Most of the Chamorro families left their homes in Hagatna and moved to their ranches, where they stayed until they were forced to march to Manenggon just prior to the American re-taking of the island.

Beginning in the early part of 1944, if not before, the Japanese began to fortify the island against an American invasion. In anticipation of an attack from the sea, the section of the shoreline extending south from Tumon Bay to Agat was fortified (Crowl 1960:333). A labor force of Chamorro male conscripts dug the caves and trenches, built pillboxes and barricades, and laid the underwater mines which made up the coastal defense system. The defenses in Piti included a gun emplacement (Piti Coastal Defense Gun, GHPO Site No. 66-01-1046) and defensive positions located in the hills behind the village (Dave DeFant, pers. comm. 2008).

American forces landed at Agat and Asan on July 21, 1944, and it took nine days of fierce fighting to reach the Final Beach Line, an arbitrary line drawn along the high ground from Adelup south to Facpi Pt., and to secure Orote Peninsula. After losing this ground, the Japanese troops withdrew to the Mt. Santa Rosa and Mt. Mataguac areas in northern Guam for a final stand. On August 10, Guam was again controlled by the Americans (Rogers 1995:193). One last battle occurred on August 10-11. When it was over, Tokyo acknowledged the fall of Guam. On August 15th, the U.S. Island Command took over the administration of Guam (Rogers 1995:193).

Second American Period

The post-war years have seen major changes in landscape and lifestyle on Guam. Population has increased as have business and government agencies. In 1950 the Organic Act was passed, granting U.S. citizenship and some measure of self-government to the Guamanian people. The requirement of U.S. Navy security clearance to enter Guam was lifted in 1962, and by the mid-1960s Japanese tourists began to visit the island. The Vietnam War military build-up and refugee influx in the 1970s was followed by immigration from neighboring islands. Presently there are c. 150,000 residents and the U.S. military bases are undergoing another build-up of personnel, facilities, and equipment.

HISTORY OF THE PITI AREA

Portions of the Piti area were likely occupied during Prehistoric times as the early historic accounts mention the place name Tepungan (Garcia 1683) and Hornbostel's 1920's map of Guam shows latte sets along the Piti shoreline (Fig. 4).

Apra Harbor became the favored anchoring spot on Guam during the Spanish Period. The Manila Galleons, as well as the vessels of the visiting explorers (Kotzebue, Freycinet, Lutke, d'Urville) and the whalers (who regularly stopped on Guam after 1823) sailed into Apra Harbor.

There were two landings where passengers disembarked and cargo was unloaded. One was at Sumay, on Orote Peninsula, and the other was at Piti in the vicinity of the present power plants (west of SMP). Of these two landings, apparently Piti was the favored spot, perhaps because the road from Piti to Hagatna was in better condition, and the distance to Hagatna was much shorter. An inspection of Guam's roads and bridges in 1833 indicated that "pillars of

mamposteria have been placed for the construction of a substantial bridge to cross the Mazo” [sic] (Villalobos 1833).

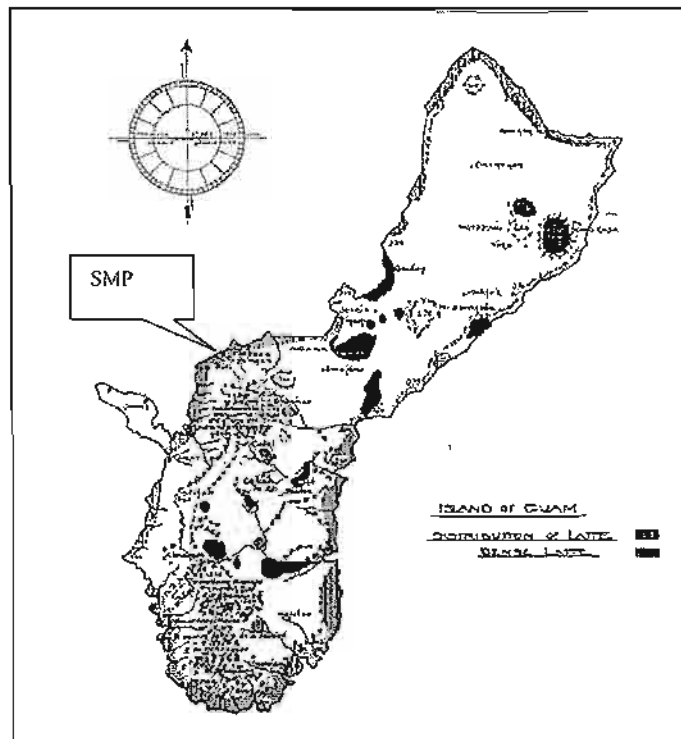


Figure 4. Hornbostel’s map of Guam made in the 1920s showing the distribution of latte sets on the island at the time.

An 1870 description of the road between Piti and Hagatna indicates that it was “six *varas* wide with solid wooden bridges across all streams and marshy places so that one can travel over it in any kind of vehicle” (Corte 1870:138). Governor Olive (1984:29, 53) improved the road during his term (1884-1887) by creating a very good bed of coral gravel; he described the road after the improvements as having an “excellent roadbed”. The wooden bridges were mounted on “masonry supports”. In 1891, this road, then known as Chorillo Road, was the island’s main roadway (Ibanez et al. 1976:76).

Governor Olive (1984:26) indicated that the huts of the village of Tepungan stretched along the road from a point just west of Asan Pt. (east of SMP) to the landing place at Puntan Piti (west of SMP). On the early maps (see below), the place name Tepungan is located along the shoreline east of the SMP project area. A census taken in 1886 lists 234 people living in Tepungan (Olive 1984:89). As there was no separate listing for Piti in this census, it is assumed that the people living in Piti were included in the Tepungan count.

As the landing at Puntan Piti was developed and people began settling nearby, the village of Piti was eventually recognized. In 1887, Marche (1982:2) described Piti as a “small hamlet of a dozen huts.” Living in the village were the harbor captain and the *alcalde*. The residents of Piti maintained fish weirs on the reef flat at the mouth of the Masso River (Ibanez 1887:93; Olive 1984; see Moore and Hunter-Anderson 2005).

Figure 5 shows the Piti shoreline and the mouth of the Masso River in 1901. Shortly after gaining control of the island in 1898, the U.S. Navy began additional improvements to the Piti landing. A Navy Yard was built inland of the Piti landing, the quay was extended, and a storage shed was constructed. A power line was extended from the coal-burning power plant in Agana to Piti. Early (1901-02) in the First American Period, Chorillo Road was rebuilt and its name changed to the Agana-Piti Road.

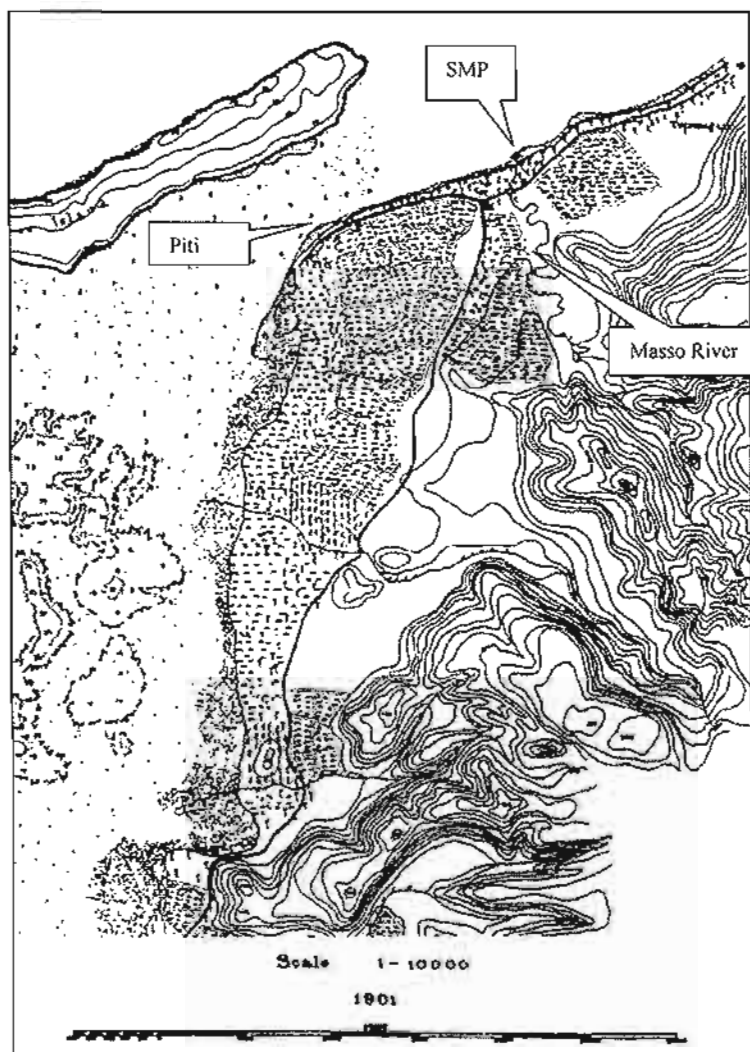


Figure 5. Section of a map of the Harbor of San Luis D'Apra prepared in 1901 showing the Piti vicinity. The SMP project is near the mouth of the Masso River. Note the fields. The place name Piti is at the end of the road, west of the SMP. The place name Tepungan is east of the SMP. The map is from the collection of the Micronesian Area Research Center.

The Piti section of the road was described in 1905 (Cox et al. 1926).

"From Tipungan [sic] to Piti the road runs parallel to the beach and through a wide, flat bottom, cultivated in cocoanuts [sic], bananas, and garden truck. The road to Agat branches from the Piti road about a quarter of a mile from the latter town proper, and

from the junction of the two roads to the boat landing at Piti picturesque native huts line the western or seaward side of the road. At Piti are three storehouses owned by the island trading companies, a naval storehouse, quarters for officers and marines, the governor's summer cottage, the custom-house, a steam-launch railway, and a good landing wharf for small boats. East of Piti and adjoining the village is a large rice swamp, water for which is led from a dam built in the hills, impounding the headwaters of the Masso River. To the southward the mangrove swamp begins and holds its own almost without a break...After the Masso [River], a turn is made to the southeast, and a half mile of good bottom land, cultivated at two or three points in sugar, leads to the edge of the wooded land just back of the mangrove swamp."

In 1933, the dredging of the Agana-Tepungan channel was completed to provide a minimum width of 50 feet and a minimum depth of 6 feet at low tide (Alexander 1933:71; 1935.) Possibly some of the dredged material generated by that project was placed on the nearby shoreline, in the vicinity of the SMP project area. Once it was finished, barges used the Tepungan channel to transport coal from Cabras Island to Agana, where it was used to fuel the power plant (Hunter-Anderson et al. 1995). On Cabras Island the navy built a quarantine station and a coal shed. A causeway linked the island with the Piti shoreline.

By 1910, a piped water system for Piti had been completed (Anonymous 1910). Public hydrants were installed every 500 ft along the pipeline and they provided free water to the residents. Labor to build the reservoir and lay the pipe system was provided by Piti residents. A section of a map of Guam in 1913-14 shows the Masso River, Tepungan to the east, Piti to the west, the landing wharfs, the roads, the causeway, and the fields in the vicinity of the SMP (Fig. 6). Several structures are shown along the shoreline north of the road near the mouth of the Masso River. If the course of the river and the edge of the shoreline have not significantly changed since that time, then it appears that some of these structures would be in the area now forming SMP. However, the causeway and the landing wharfs would have been west of the SMP.

In 1914, shortly after the outbreak of hostilities between Japan and Germany, a German ship, the SMS *Cormoran*, steamed into Apra Harbor hoping to purchase enough coal on Guam to permit the vessel to reach safe haven in German East Africa (Rogers 1995:135). When Guam could provide neither enough coal nor provisions, the vessel remained anchored in Apra until it was scuttled in 1917, shortly after the United States declared war against Germany (Rogers 1995:139). While on Guam, the uniformed but unarmed crew members were permitted on shore in the Hagatna-Piti area (Rogers 1995:135). Among the crew were 28 Papuans and four Chinese (Rogers 1995:135). After the scuttling, the German officers were held at Camp Barnett and the enlisted crew was held at Asan until they were all sent to the United States in 1917 (Rogers 1995:140). The men from New Guinea were "housed in a camp at Piti called 'Cannibal City' by the locals, worked for the navy until all, except one who died, were repatriated on 2 January 1919 by the British (who had taken over Papua New Guinea) on a leased Japanese schooner" (Rogers 1995:140).

After the departure of the Germans and the Papuans, life in the Piti area resumed. A 30-acre tract of land near Piti, on the inland side of the road, was selected for an agricultural experiment station (Nelson and Nelson 1992:175). In 1924 the Guam Agricultural School opened at the site with an enrollment of thirty-two boys. Pomeroy, a Navy contractor, built a

barracks near Piti (Apple 1980) and because Navy Yard was located in Piti, some navy men married to local women made their homes there (Guampedia—O'Brien account). Tony Palomo (pers. comm. 2008), a local historian, suggests that over the years many outsiders chose to settle in Piti because of its location near the port.



Figure 6. Section of a map of Guam showing the place names, roads, trails, and fields in the vicinity of Piti. Note the possible structures in the SMP project area. Taken from a map compiled by U.S. Corps of Engineers (1914) on file at the Micronesian Area Research Center.

By 1941, the road between Sumay and Hagatna had been paved; at the time it was the only road on the island with an asphalt surface (Rogers 1995:158).

Prior to taking the island in 1941, the Japanese bombed the Navy Yard at Piti (Denfeld 1997) (Fig. 7). Shortly after taking the island, the Governor, marines, sailors, civilian construction workers, and American residents were marched from Hagatna to Piti where they were loaded on board the Japanese vessel, *Argentina-maru*, and transported to prison camps in Japan (Carano and Sanchez 1964:272). No description of the Piti area during the Japanese Occupation was found and it is not known how it was modified, but the Japanese occupied at least one of the privately owned homes located there (Guampedia—O'Brien account).

When the Americans took Cabras Island in July 1944, they found that the Japanese had mined it and equipped it with dummy coastal defense guns (Apple 1980). The Japanese had also fortified the Piti shoreline by emplacing guns (Piti Coastal Defense Guns, 66-03-1046) in the hills behind the village (Apple 1980).

The villages of Piti, Tepungan, and Asan were nearly destroyed during the American invasion. After WWII, the Agana-Piti road was rebuilt and renamed Marine Drive, in honor of the Marines who recaptured Guam (Apple 1980:61). Recently the name of this road was changed to Marine Corps Drive. The SMP project area lies between the road and the shoreline.

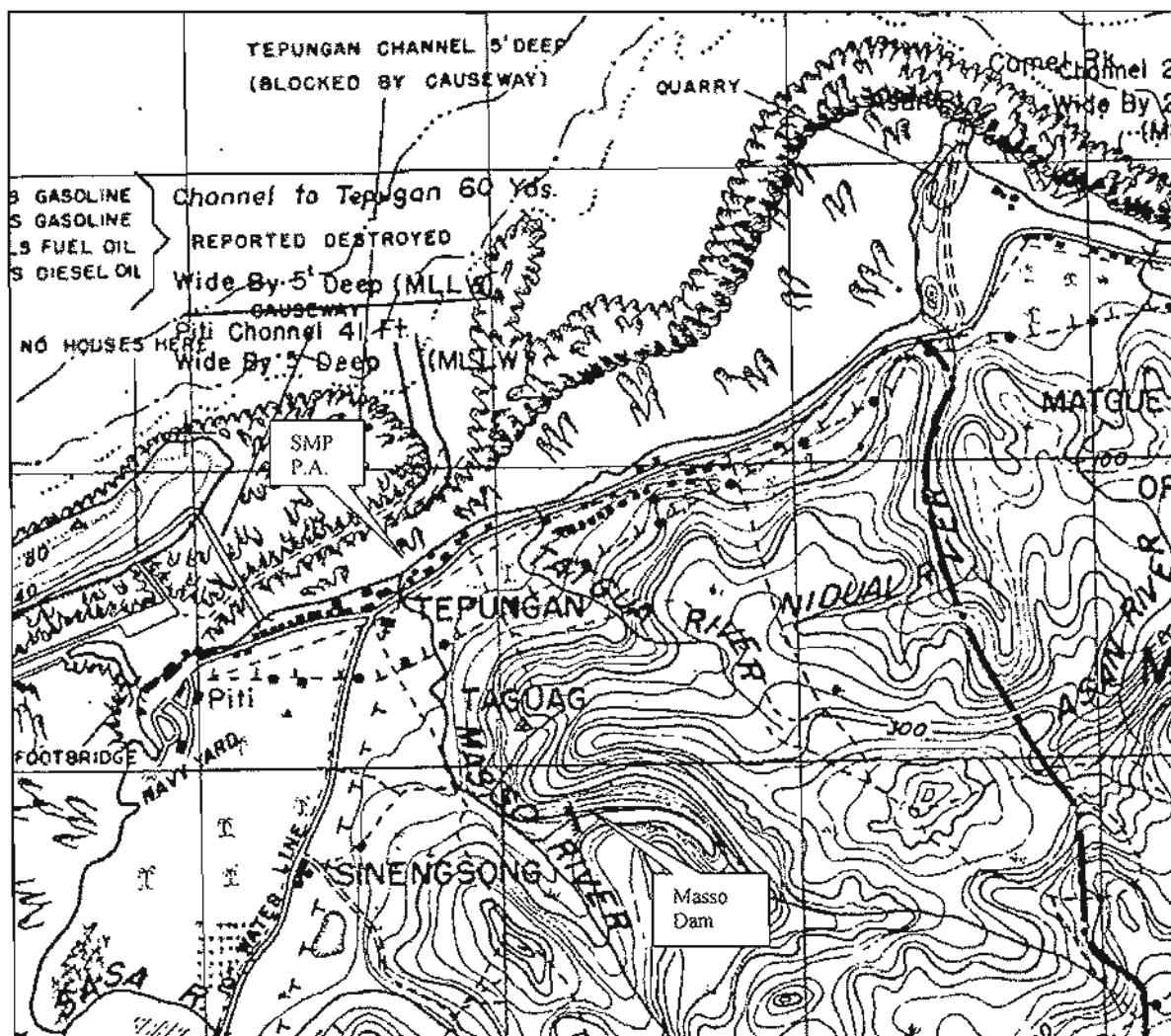


Figure 7. Section of a map of Guam showing the Piti shoreline, the Navy Yard, the dam on the Masso River, and the structures on the beach on either side of the Masso River mouth in the vicinity of the SMP project. Taken from the Marine Schools map of Guam made in 1922 showing corrections up to 1942.

Immediately after the retaking of Guam, the U.S. established a recreation beach at Hoover Park (west of SMP) and it appears that the SMP area was used for stockpiling pipe segments (Fig. 8). It may be that much of the quarried limestone base course noted in the backhoe trenches (see below) was laid at that time to create a stable, clean surface for the storage area. The dredged material noted in other backhoe trenches could have been introduced about the same time, or during the First American Period.

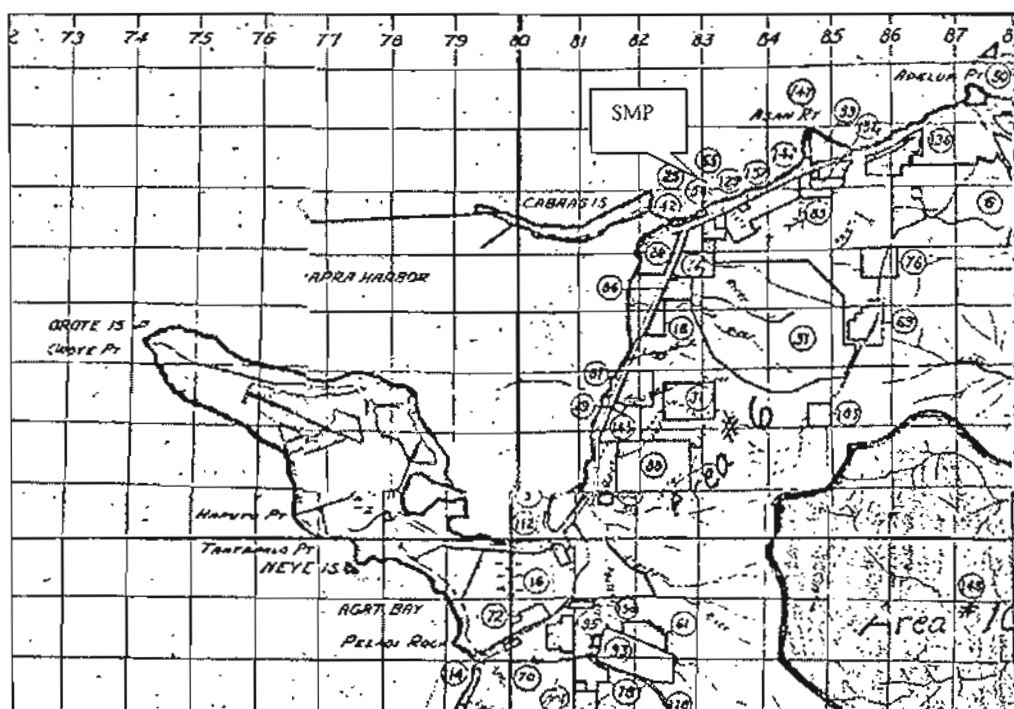


Figure 8. A portion of the Area Allocations Map dated October 1945 showing how parts of Guam were being utilized by the US military. Pertinent numbers in the SMP vicinity appear to be 42, 25, and 54. Designations for those numbers are: 42 is Fleet Recreation, Piti (and that is probably Hoover Park and possibly part of SMP); 25 is Freight Receiving and Redistribution Unit; and 54 is 5th NC Brigade Pipe Yard. On this map, the place name Piti Village (141) is shown near Asan Pt., east of SMP.

Marine Corps Drive linked the Navy base on Orote Peninsula with the Air Force base established at the northern end of the island. As the new road passed through the Piti area, it mostly followed the earlier route of the pre-war road, although there were modifications near its intersection with another new road leading to the breakwater and port facilities on Cabras Island and the power plants near the former Navy Yard. Eventually the power plants took over much of the area near the former quays and landings of the Navy Yard. Following WWII, the main part of Piti Village was established between Asan Point and Hoover Park, and private residences and business line both sides of the road as it passes through this area. The church and some of the new homes were built inland, near the base of the hills. Across the road and directly south of SMP is one of Piti's oldest houses. It was built after WWII. Associated with this tin house, belonging to the Quan family (long-time Piti residents), is an outdoor kitchen with a brick oven (*hotno*), concrete sink, barbeque, and cistern or water catchment (Moore and Steffy 2008). Large mango and breadfruit trees grow on the property. Another brick *hotno*, belonging to the Fejeran family (also long-time residents of the Piti area), is located a short distance southeast of the Quan property (Moore and Steffy 2008).

Piti Mayor, Vicente Gumataotao, was born in the village of Sumay in 1927. During WWII he worked in the Atantano rice fields and collected clams from the mangrove areas in Apra Harbor. After the Americans recaptured the island in 1944, he lived and worked in Toto

for the 5th Service Depot. He joined the U.S. Navy, and after serving for 28 years, he returned to Guam, settled within Piti district and was elected Mayor in 2005.

The Mayor was not the only person to indicate that mangrove areas in Apra Harbor contained abundant bivalves prior to WWII. Informants interviewed by Amesbury (1996:27) told her that in pre-war times people used to collect sacks of bivalves from the Piti area and carry them to Hagatna to sell.

According to various informants, the SMP park was last modified in the late 1970s. The basketball court is now defunct and the restroom facilities are in need of renovation. The park lacks lighting and functioning water faucets. The reef area adjacent to the park is now part of a designated marine preserve monitored by the Dept. of Agriculture, Division of Aquatic and Wildlife Resources. Limited fishing is allowed during certain times, using certain methods, to catch certain species. At present the park is used by fishers and picnickers. The Mayor hopes the proposed improvements will make the park a more integral part of the Piti community.

ARCHAEOLOGICAL BACKGROUND

The amount of archaeological work completed in the vicinity of Piti is limited. Reinman (1965) recorded an eight-stone latte set (GHPO Site No. 66-03-0137) with seven pillars in place. This set, which was visited by the author in 1994, is located south of the pipeline road (Wells et al. 1995:29), west of the SMP and the power plants. Associated with the set was a basalt mortar that was subsequently moved by the government to the Governor's Office in Adelup (Wells et al. 1995:29).

An archaeological survey for the Harbor of Refuge in the lower Piti channel area found no significant cultural resources, but a number of historic glass bottles were collected (Hernandez 1984). Some of the bottles date to pre-WWII times and they provide tangible evidence that the channel and the area in the vicinity of the pre-war quays were utilized during the First American Period and even earlier.

MARS monitored trenching in the Piti area associated with the reconstruction of Marine Corps Drive during the period from 1990-1993 (Wells et al. 1995). The trenching, which occurred on the seaside of the road, did not expose any significant cultural deposit as it passed the SMP area (Wells et al. 1995).

In 1992 PHRI completed an archaeological survey and subsurface testing in the Aspaalas and Nimitz Hill Development Parcels in the Tepungan area, along the shoreline east of SMP near the Fish Eye Marine Park (DeFant, pers. comm. 2008; Workman and Haun 1992). This project extended from Marine Corps Drive to the inland uplands. Seven archaeological sites were identified, three of these were on the coastal lowland where a series of 70-80 backhoe trenches were dug. The coastal lowland sites consisted of three large surficial artifact scatters with cultural deposits attaining considerable depth ranging from .80-1.55 m below ground surface. Historic items included red clay tiles and tile fragments, one porcelain fragment, one stoneware fragment, some pieces of metal, and the remains of a possible well. Pre-Contact materials included *Tridacna* shell adzes, worked and unworked *Isognomon* shell, ground stone tools, chert flakes, Latte Phase pottery (23 sherds), and human skeletal remains. No hand excavations were completed and no radiocarbon dates were reported.

An archaeological investigation of Parcel 1B in Piti, west of the SMP project near the pipeline road, found that most of the ground surface had been previously disturbed (Hunter-Anderson et al. 1995). Loose latte elements from a disturbed latte set and a basalt mortar not associated with a cultural deposit were identified during the survey. These ruins signify that the area had been utilized during the Latte Phase. Based on the historic glass and ceramic fragments found on the project area surface, some dating to the mid 1800s, the authors (Hunter- Anderson et al. 1995) suggested that people used this area during the late Spanish Period and up to WWII.

In 2001, MARS monitored trenching for the cable landing at the Piti Landing Site on Lot 58-1-New-1-1New, Piti (Hunter-Anderson 2002:34). This lot is located just east of the SMP project area; the present drainage ditch separates the two parcels. At the time there was a vacant concrete house on the lot which was demolished prior to the trenching. In the trench, about six feet of brown sticky clay were exposed above a gleyed deposit and old reef platform. No intact cultural deposits or features were observed in the trench, but several cultural items were collected from the back dirt piles, including a few prehistoric pottery sherds, animal bones, broken and whole Coca-Cola bottles, broken and whole Japanese bottles, Japanese ceramic fragments and a button. Unexploded ordnance was also encountered and reported to the appropriate authorities.

ARCHAEOLOGICAL EXPECTATIONS FOR THE PROJECT AREA

Based on the archival review, it was anticipated that cultural deposits and features associated with the Latte Phase, Spanish Period, and First American Period could exist in the project area. If intact Latte Phase deposits are present, then human skeletal remains also could be expected. However, since monitoring on the adjacent lot immediately east of the SMP and the previous monitoring of the trenching along the highway did not expose any significant intact cultural deposits, there was also the distinct possibility that no significant deposits would be present in the SMP project area.

RESEARCH QUESTIONS

While not as controlled and reliable as data from hand excavations, the data collected during subsurface testing using a mechanical excavator can be used to address the following kinds of questions pertaining to site assessment for historical significance: What is the general stratigraphy in the area, does it contain evidence of historic and/or prehistoric occupation, and are the deposits intact or disturbed? Information gathered from the project area helps to determine how and when this part of the Piti shoreline was used in the past.

LETTER REPORT

On December 8, 2008, MARS submitted a Letter Report to DBCA summarizing the field findings and our recommendations with respect to impacts that the proposed improvements at the park may have on historic properties.

TECHNICAL REPORT

This technical report presents a more detailed account of the field findings and the results of laboratory analyses undertaken on the materials that were collected. MARS will submit a copy of the technical report to the HPO on behalf of DBCA. Once it has been accepted by the

HPO, copies will be donated to the Guam Museum, Micronesian Area Research Center, Univ. of Guam and the Nieves Flores Memorial Library in Hagatna.

MARS QUALIFICATIONS

The archaeological investigations were conducted according to the Secretary of the Interior's historic preservation standards and guidelines. The MARS staff members are familiar with Guam archaeology and have routinely performed the kinds of work needed for this project.

DISPOSITION OF ARTIFACTS AND SAMPLES

After the laboratory analyses have been completed and the Technical Report approved by the Guam HPO, all artifacts and samples will be deposited with the Guam Museum.

RESULTS OF FIELD WORK

The backhoe trenching was accomplished December 1 and 2, 2008. Twelve trenches were dug (Fig. 9). Archaeologists in the field were Judith R. Amesbury and Darlene R. Moore. Backhoe service was provided by International Consolidated Contracting, Tamuning. The field work was guided by the Scope of Work approved by the Guam Historic Preservation Office. The scope called for 6 to 8 trenches to be dug; 12 were completed.

An inspection of the SMP's ground surface prior to deciding where the backhoe trenches should be placed identified no exposed cultural material. An inspection of the intermittent drainage channel located on the east side of the project area noted a few eroded Latte Phase pottery sherds that could have been carried to this area by flowing water. An inspection of the beach deposits (Photo 2) identified numerous pieces of glass from broken soda and beer bottles, none particularly old looking, along with soda and beer cans and unidentified metal fragments. No prehistoric sherds were observed on the beach. A variety of marine shells was present. The beach is comprised of white sand derived from the reef and black sand derived from terrigenous sources and carried to this area by the Masso River. A sample of the black sand was collected and brought to the MARS laboratory where it was found to be easily attracted to a magnet. University of Guam professor, Rich Olmo, identified the black, shiny inclusions as magnetite. The black sand also included rare bits of quartz. Both magnetite and quartz occur naturally in the geologic formations forming the hills inland of the Piti area.

The shoreline along the north edge of the SMP is eroding. Photo 2 shows a line of rocks extending into the water where land was formerly located on the west side of the Masso River mouth. Apparently as the land eroded, only the rocks remained. However, Mayor Gumataotao is of the opinion that some of these rocks were dumped there during former dredging events. Photo 3 shows the mouth of the Masso River.

A concrete bridge and an old unused section of the main road are located in the southwest portion of the park. Currently the bridge, which spans the Masso River, is overgrown with vegetation. It was not cleared and its exact age was not determined. Mayor Gumataotao (pers. comm. 2009) indicates that these two features are remnants of the pre-war road system that formerly linked Piti with Hagatna. During the park renovations they should be avoided and a barricade erected as some slumping has taken place. The resulting cavity near the bridge presents a potential hazard to park visitors, particularly young children.

Stratigraphic information was recorded for each of the twelve backhoe trenches, and detailed drawings were prepared for four representative trenches. Portable remains of diagnostic value were recovered (see Field Catalog, Appendix A). An opportunistic sample of marine shells was collected in order to list the range of shells present in the project area. No significant intact cultural deposits, shell middens, or cultural features were exposed.

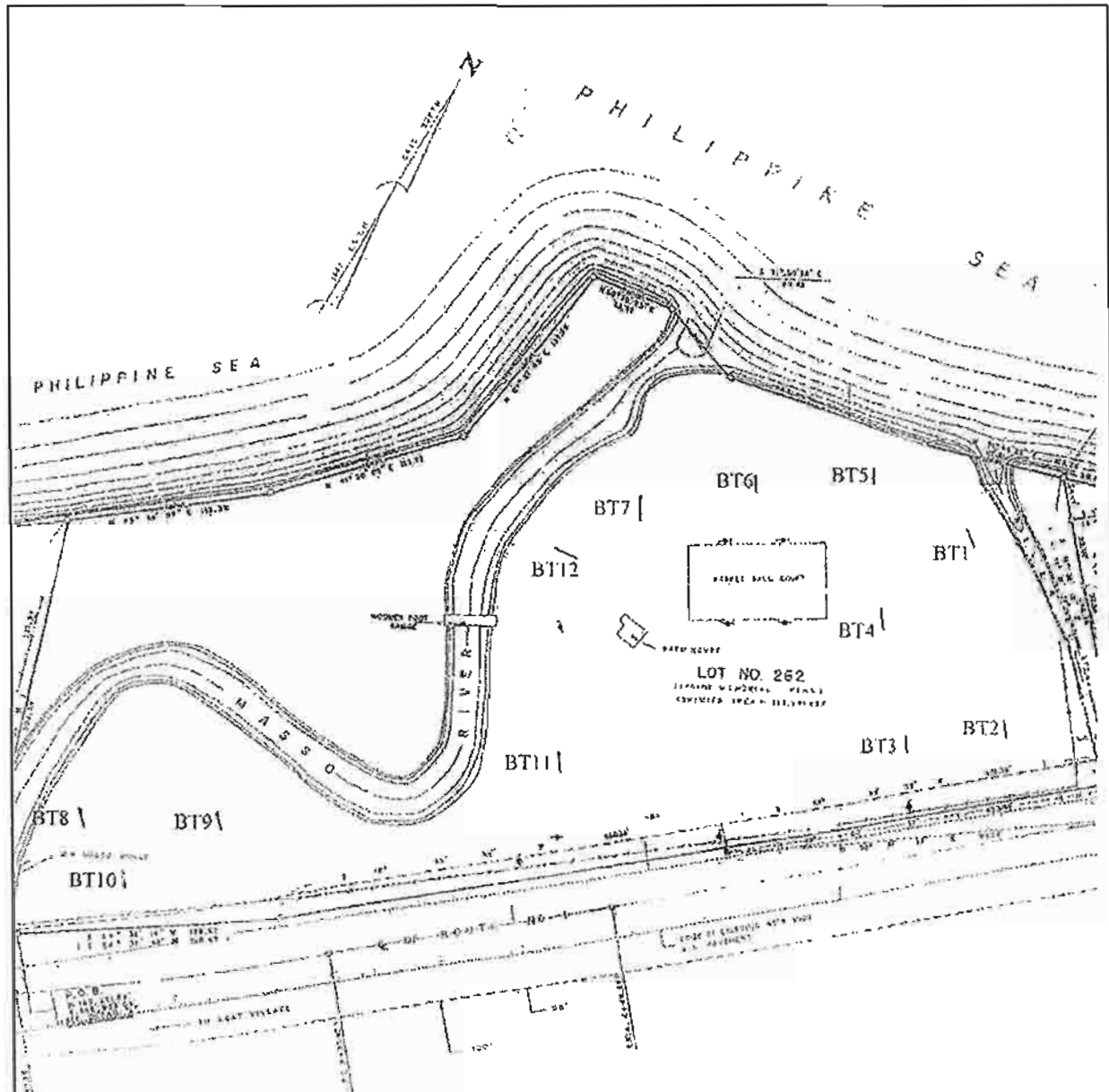


Figure 9. Plan of Santos Memorial Park showing the locations of Backhoe Trenches 1-12. Note the line pointing to the Old Masso Bridge in the lower left hand corner of the project area.



Photo 2. View of Santos Memorial Park's eroding shoreline and beach deposit. The power plant and Cabras Island are in the background.



Photo 3. View of the Masso River mouth. The camera is facing southwest.

Generally, a thin layer of humic topsoil has developed across the project area (Table 1). The thickness of this topsoil ranges from 4 cm to about 16 cm. It is thicker toward the beach (see BT 7).

Table 1. Pertinent information regarding the Backhoe Trenches by number.

Number	Size (m)	Depth (cm)	Stratigraphy (cm)	Location and Trench Orientation (S to N)
BT 1	4.0 long 1.0 wide	120	0-5 humic topsoil 5-65 limestone base course 65-80 dark brown clay 80-120 brown clay	39.8 m, 04° from 1 st concrete power pole Orientation 313°
BT 2	3.0 long 1.0 wide	120	0-5 humic topsoil 5-65 limestone base course 65-120 stiff mottled red/brown clay	27.7 m, 36° from 1 st concrete power pole Orientation 323°
BT 3	4.0 long .90 wide	120	0-7 humic topsoil 7-40 white limestone base course 40-67 orange limestone base course 67-120 stiff mottled red/brown clay	4.8 m, 342° from 1 st concrete power pole Orientation 323°
BT 4	5.5 long .75 wide	170	0-35 white limestone base course 35-95 orange limestone base course 95-170 moist stiff mottled black clay	23.3 m, 322° from 1 st concrete power pole Orientation 320°
BT 5	4.0 long .85 wide	200	0-12 humic topsoil 12-22 white limestone base course 22-120 orange limestone base course 120-200 moist stiff brown sandy clay water table at 175	39.6 m, 30° from wooden power pole on south side of basketball court Orientation 328°
BT 6	4.0 long .85 wide	114	0-4 humic topsoil 4-50 light brown sandy clay 50-94 brown sandy clay 94-114 gley sand water table at 100	12.1 m, 310° from wooden power pole on north side of basketball court Orientation 330°
BT 7	5.0 long .65 wide	135	0-25/40 topsoil – thicker toward beach 30-70 limestone base course 70-135 brown sandy clay water table at 135	34.2 m, 240° from wooden power pole on north side of basketball court Orientation 317°
BT 8	3.5 long .75 wide	155	0-16 humic topsoil 16-66 dredged sand and coral fragments 66-155 mottled reddish brown clay	39.4 m, 258° from 3 rd concrete power pole Orientation 316°
BT 9	5.0 long .75 wide	150	0-18 humic topsoil 18-36 dredged sand and coral fragments 36-70 brown clay 70-150 mottled reddish brown clay	21.2 m, 274° from 3 rd concrete power pole Orientation 318°
BT 10	3.6 long .70 wide	100	0-12 humic topsoil 12-44 dredged sand with branch coral 44-100 mottled reddish brown clay	21.2 m, 238° from 3 rd concrete power pole Orientation 320°
BT 11	3.6 long .70 wide	135	0-10 humic topsoil 10-26 fine compacted limestone fill 26-63 dredged fill with coral boulders 63-135 reddish brown mottled clay	22.8 m, 330° from 2 nd concrete power pole Orientation 330°
BT 12	4.0 long .90 wide	125	0-5 humic topsoil 5-55 dredged coral boulders 55-125 brown clayey sand	18 m west, 258° from west end of restroom wall Orientation 80°

Throughout most of the area there is a layer of introduced fill below the topsoil. In most trenches, the fill consists of quarried limestone-gravel base course. However, on the west side of the park the introduced fill consists of material (sand and coral) dredged from the reef flat. The thickness of the introduced fill material varies across the project area from no fill in BT 6 to 108 cm of fill in BT 5. BT 6, which is near the beach and the mouth of the Masso River, is the only trench without introduced fill material. On the other hand, BT 5 which is also near the shoreline, has 108 cm of fill. In the other ten trenches, the thickness of the fill material ranges from 32-95 cm. Contained in the fill were a few pieces of coal. Since there was once a coal station on Cabras Island, finding coal in this area is not considered unusual.

Below the introduced fill is a layer of moist, very stiff brown to brownish red clay. In addition to containing very little cultural material, this deposit also lacks abundant faunal remains including marine shell and reef material that could have been incorporated into the soils through natural means (storm related wave action). It is likely that these clays developed in place or were deposited through erosion as surface water carried down soils originating further inland.

The water table was encountered in some trenches, at 1.0 m (BT 6 near the beach), and 1.75m (BT 5 also near the beach).

Generally, pieces of historic ceramics and glass from broken Coca Cola and other soda and beer bottles were observed in the clay just below its contact with the fill. The glass was mixed with a few marine shells. Based on the relatively modern age of the materials noted immediately below the fill, it seems that most of the quarried fill was laid down during the WWII military buildup in 1944-45. The dredged fill material may have been laid down then too, or it may date to the First American Period when the Tepungan Channel was dredged (see above).

There were some variations in the deposits below the introduced fill material. For example, in BT 4 the clay layer was very moist and contained abundant decaying plant parts which suggests that this portion of SMP formerly was a lowlying area that once supported water tolerant plants. A sample of the plant material was collected and sent to Hawaii for identification (Appendix B). It was identified as an unknown palm, not coconut. It is likely that the material derives from plants that were cleared prior to the introduction of the fill material. As could be expected, the clay layer exposed in the three trenches (BT 6, BT 7 and BT 12) located nearest to the Masso River had a much higher content of sand than did those located away from the river.

BT 1-BT 5 were dug on the east side of the project area, east of the basketball court. Photo 4 is an overview of the BT 1-2 area with the drainage ditch in the background.

The west face of BT 1 is shown in Fig. 10 and see Photo 5. A 20 cm thick layer of dark brown clay (II) occurs below the quarried limestone base course (I). From 80 to 120 cmbs there is a layer of stiff brown clay (IV). A slab of green tuffaceous sandstone (possibly cultural) and five pottery sherds were recovered, one from 104 cmbs (shown on Fig. 10). The pottery sherds are eroded. Exposed at the north end of the trench there was a lens of black clay extending from 60-80 cmbs. A soil sample was taken (Cat. No. 2). The laboratory examination of this soil suggests that it contains the same elements as the natural occurring black sand that was collected from the beach.



Photo 4. View of the east side of the project area. BT 2 is on the right and BT 1 is on the left. The camera is facing northeast.

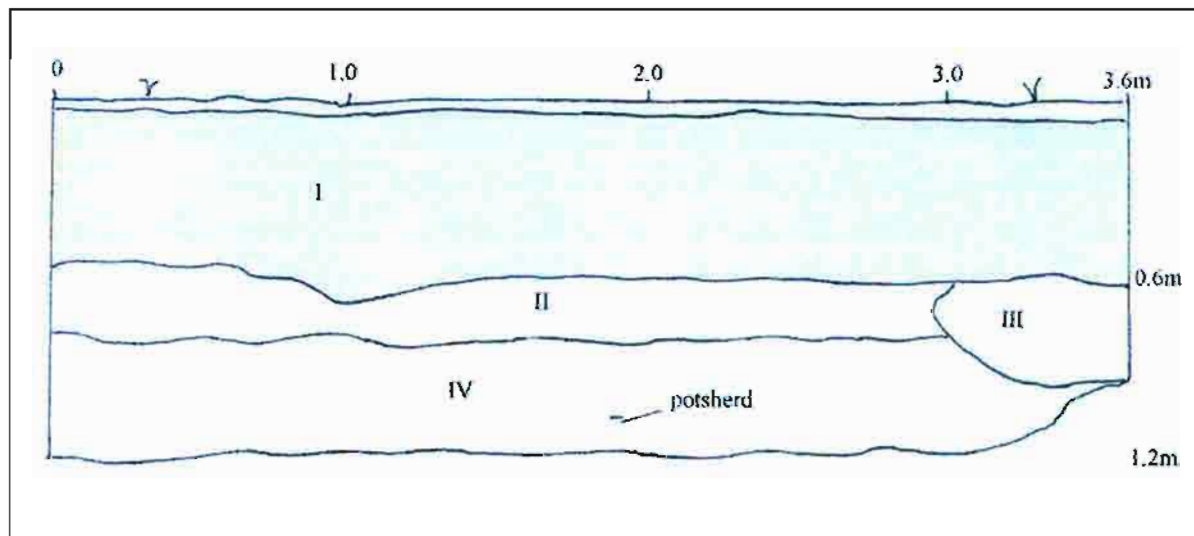


Figure 10. West face of BT 1. The uppermost portion of the deposit is humic topsoil. Layer I is a deposit of introduced quarried limestone base course. Layer II is dark brown clay containing a marine shell and a small historic ceramic fragment. Layer III is black clay. Layer IV is brown clay containing a few eroded pottery sherds, one in the trench wall about 104 cmbs. Also recovered from the brown clay was a slab of tuffaceous sandstone (see below).



Photo 5. BT 1, west face, showing the quarried fill material that forms Layer I.

BT 2 was situated on the southeast side of the project area. The humic topsoil was 0-5 cm thick. From 5 to 65 cmbs there was an introduced layer of fill (Photo 6). From 65 to 120 cmbs there was a stiff, reddish brown clay layer that was culturally sterile. One *Anadara antiquata* shell (Cat. No. 6) was collected from the back dirt.



Photo 6. BT 2 showing the south end of the trench. The light material is the quarried fill that overlies the brown clay.

BT 3 was situated west of BT 2. The trench was 4 m long, .90 m wide, and 1.20 m deep. From 0-7 cm was topsoil. From 7-67 cmbs was introduced limestone base course. From 67-120 cmbs was a very stiff, brownish red mottled clay. No cultural material was seen and no collection was made.

BT 4 was situated north of BT 3 in an area that looks paved on the surface. The paving is the result of limestone base course which has solidified. The trench was 5.5 m long, .75 m wide, and 1.7 m deep. In this area there is no topsoil. From 0-95 cmbs there are layers of quarried base course. From 95-170 cmbs there is moist, black mottled clay with decayed plant parts. A sample of wood from the 135-170 cm level was collected and sent to Hawaii for identification (Appendix B).

The east face of BT 5 is shown in Fig. 11. This 4.0 m long trench was located east of the basketball court and east of the large tree near the beach. Its north end was 10 m south of the inland edge of the beach. The trench was 2.0 m deep and the water table was reached at a depth of 1.75 m. The introduced fill (I) was 1.08 m thick.

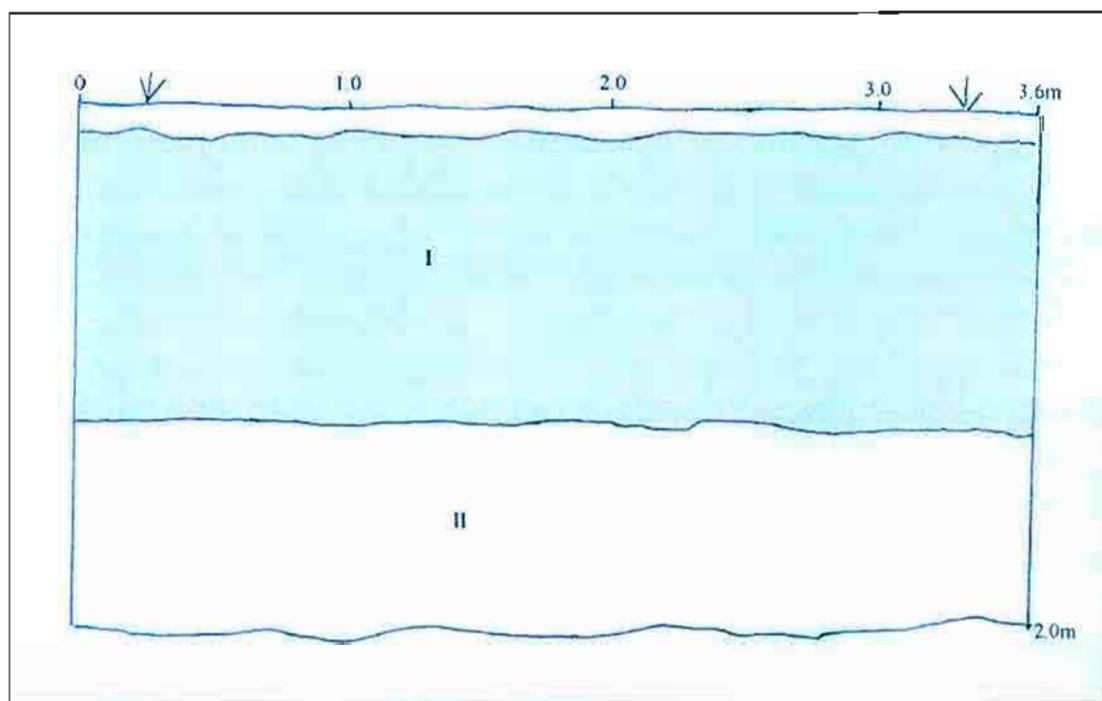


Figure 11. East face of BT 5. In this area the humic topsoil is .18 m thick. Layer I is introduced quarried limestone fill to a depth of 1.08 m. Layer II is moist brown sandy clay containing glass fragments, metal, plastic, and a few historic ceramic pieces, mixed with marine shells and a few eroded pottery sherds.

BT 6 and 7 were located north of the basketball court on either side of the beach pavilion. The east face of BT 6 is shown in Fig. 12. The north (seaward) end of the trench is 12.3 m south of the eroded edge at the inland edge of the beach and the south end of the trench is 11 m east of the southeast pillar of the beachside pavilion. Immediately south (inland) of the trench the ground surface begins to rise for the basketball court. There is no introduced fill in the trenched area. A 45 cm thick layer of brown sand occurs below the 4 cm thick humic topsoil. The light

brown sand contains the shells of African land snails, pieces of bottle glass (CocaCola, Byerly, various beers), scattered marine shell, and coral fragments. Below this modern layer was a 44 cm thick, culturally sterile, layer of brown sandy clay. The water table was reached at 100 cmbs, and the moist soil at that level was gleyed sand. No collection was made.

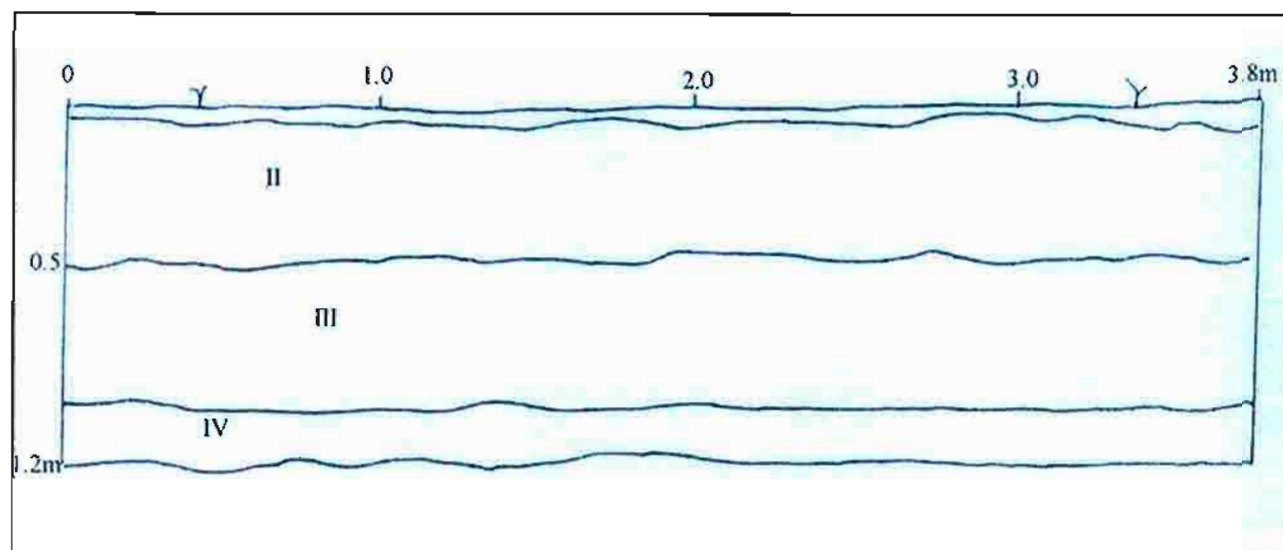


Figure 12. West face of BT 6. This trench lacks Layer I, which is the introduced fill material. Below the humic topsoil is Layer II, light brown sand that contains the shells of African Land Snails, pieces of glass from beverage bottles (Coca Cola, Byerly, beer) and marine shells. Layer III is culturally sterile, brown sandy clay. The water table was reached at 1.0 m and a wet gleyed deposit (IV) occurs from 95 cmbs to the base of the trench at 1.2 m.

BT 7 was located west of BT 6 and 20 m southeast of the Masso River. It was 5 m long, .65 m wide, and 1.35 m deep. From ground surface to a depth of 25/40 cmbs there was a layer of humic topsoil, thicker nearer the beach. From 30-70 cmbs there was a layer of quarried limestone base course. From 70-135 cmbs there was brown sandy clay containing coral fragments, a tuffaceous sandstone pebble, a chunk of coal, a piece of metal and a pottery sherd. The pottery sherd, coal, and aluminum pull tab were collected (Cat. No. 9).

Three backhoe trenches (BT 8, BT 9, and BT 10) were dug in the southwestern portion of the project area (Photos 7-8). BT 8 was furthest west. The trench was 3.5 m long, .75 m wide, and 1.55 m deep. From 0-16 cmbs was humic topsoil. From 16-66 cmbs there was a layer of introduced sand, apparently dredged from the reef. The sand contained abundant broken coral and marine shell. From 66-155 cmbs there was a mottled, reddish brown clay. The clay contained no reef material. From the back dirt were recovered a *Terebra maculata* shell, a butchered mammal bone, a sample of decaying wood, and an historic ceramic (Cat. No. 10). The wood was sent to Hawaii for identification (Appendix B). It was identified as possible *tangan-tangan*.



Photo 7. View of the west side of the project area. BT 8 is in the foreground, BT 9 is in the background (by the backhoe), and the inland picnic pavilion is to the left. The old road bed does not show in this photo, but it would be to the right. The Masso River channel is behind the pavilion.



Photo 8. BT 8, west face. The light material is sand dredged from the reef flat.

The east face of BT 9 is shown in Fig. 13. The topsoil in this area is 18-20 cm thick. A waterline, perhaps running to the picnic pavilion located in this area, was exposed at the north end of the trench about 20 cmbs. From 18 to 36 cmbs there is an introduced deposit of dredged sand and fragments of branch coral (I). Below that (36-70 cmbs), there is a layer of charcoal flecked brown clay (II) that contains a scattered mixture of historic material. A piece of metal and the base of a probable rice bowl was recovered from this layer about 44 cmbs. Below the brown clay (II) there is a deposit of reddish brown mottled clay (III). This culturally sterile layer contains few roots, no shell or other reef material.



Photo 9. View of the east face of BT 9. The meter stick is at the north end of the trench. The light material is fill material dredged from the reef flat. A waterline is exposed behind the meter stick.

Collected from the back dirt were two pieces of glass, three historic ceramics, one unidentified bone, two bivalves, a sample of decaying wood, and a possible piece of graphite (Cat. No. 12). The base of the stoneware rice bowl exposed in the trench face was recovered (Cat. No. 11). See below. The wood sample was sent to Hawaii for identification (Appendix B). It was identified as a piece of fir or pine (Murakami 2009). It is likely that this introduced wood derived from a shipping pallet, power pole, or imported construction material.

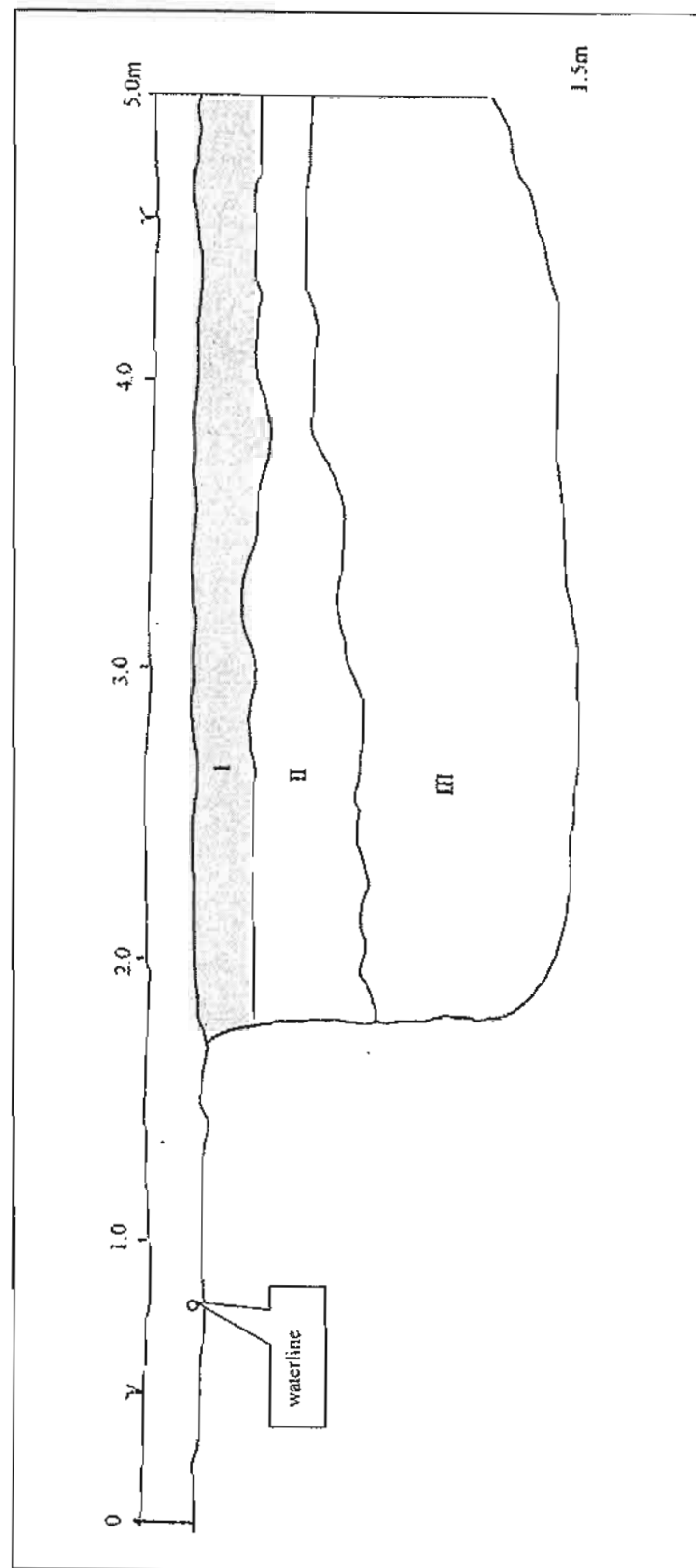


Figure 13. East face of BT 9. The uppermost portion of the deposit is a layer of humic topsoil that contains a waterline as indicated by the small circle in the shallow portion of the trench. Layer I is fill consisting of dredged material from the reef flat. Layer II is brown clay with charcoal flecks, glass fragments, unidentified metal, several small fragments of historic ceramics and the base of a probable rice bowl recovered 44cmbs. Layer III is culturally sterile reddish brown mottled clay with few roots.

BT 10 was located in the southwest portion of the project area, between BT 8 and 9, but to the south. Its south end was dug to expose the north edge of the old road bed where pavement was exposed on the surface of the elevated area. The purpose of placing the trench here was to see if more than one road building event could be identified. The surface asphalt was 2 cm thick. From 2-5 cmbs there was a shallow layer of introduced limestone base course. Below that there was another 2 cm thick layer of asphalt (5-7 cmbs). From 7-18 cmbs there was a layer of quarried limestone base course. From 18-32 cmbs there was a layer of very compacted, orangish-colored clay. From 32-65 cmbs there was a layer of introduced limestone cobbles. The sizes of the rounded cobbles ranged from about 8-10 cm along one axis. The soil below the cobbles was stiff, mottled red clay that appears to have formed in place.

The asphalt layers separated by the layer of base course indicate that two paving events had taken place previously. It is not certain whether the rounded cobbles provided the foundation for an earlier road surface that is no longer visible or were part of the road building process for the lower asphalt paving event. The archival review indicates that continuous efforts were made during the latter part of the Spanish Period and during the First American Period to maintain this road, which at the end of the First American Period was the only road on Guam to have an asphalt surface. Mayor Gumataotao indicates that this road section dates to the First American Period.

Archaeologists monitoring excavations along Guam's roads are often able to document previous road building events. For example, a layer of irregularly shaped limestone rocks was documented under the present road in Merizo by the church (Yee, pers. comm. 2008). However, the size and shape of the rocks in the Merizo roadbed were more variable than the cobbles exposed in the SMP roadbed. The material content varied as well. The Merizo roadbed included small basalt pebbles mixed with the pieces of coral that could have been collected from the Merizo beach. The SMP road bed in contrast, contained no other materials mixed with its limestone cobble layer.

The Merizo roadbed is thought to date to the mid 1800s (Yee, pers. comm. 2008). Since the SMP roadbed consists of relatively uniform quarried cobbles, it is likely to be much more recent. Exposing a larger segment of the old road bed at SMP may help to answer questions about the earlier road building techniques in Piti. The proposed improvements to SMP are not expected to impact this part of the park.

Collected from the BT 10 back dirt were a piece of glass, a nail, and two historic ceramic fragments. Two unidentified metal fittings were exposed in the north end of the trench near an old buried pipe. Each fitting has a diameter of 32 cm and is 10 cm tall. Possibly they are related to the buried pipe. The digging stopped when the pipe was encountered.

BTs 11-12 were located west of the basketball court and restroom. BT 11 was situated along the southwest side of the main part of the SMP project area. The trench was 3.6 m long, .75 m wide, and 1.35 m deep. The humic topsoil in this trench was 10 cm thick. From 10-26 cmbs was quarried limestone fill, from 26-63 cmbs was a layer of introduced coral boulders dredged from the reef. From 63-135 cmbs was reddish brown clay. No cultural material was observed. One piece of coal (Cat. No. 14) was recovered from one of the fill layers.

BT 12 was situated on the west side of the main part of the SMP project area, north of BT 11 and 9.3 m east of the Masso River, between the river and the restroom. The trench was 4 m long, .90 m wide, and 1.25 m deep. From 0-5 cmbs was humic topsoil. From 5-55 cmbs there was a layer of coral boulders and other reef material that had been dredged from the reef. From 55-125 cmbs there was a layer of brown sandy clay containing a few marine shells and some finger coral. No cultural material was seen. Collected from the back dirt were a piece of coal and some marine shells (Cat. No. 15).

The backhoe testing found that much of the area has been previously filled. The fill is particularly obvious in the vicinity of the basketball court and the restroom facility. The fill provides a good foundation for the proposed improvements to the park. Because the fill is so thick, the proposed renovations should not disturb the clay soils that lie below it. However, no significant cultural deposits were encountered in the lower soils. If the old roadbed and bridge are going to be altered or destroyed, they should be documented in detail, and a barricade or cover should be placed near the slumped area by the bridge to prevent people from falling into the cavity.

RESULTS OF LABORATORY ANALYSES

A small amount of cultural material was collected during the test trenching and brought to the MARS laboratory where it was washed, sorted by material category, counted, weighed and described. The material categories are ceramics (historic and traditional), faunal remains, glass, lithics, and metal. In addition, three samples of wood were collected. These were sent to International Archaeological Research Institute in Honolulu for identification (see Appendix B, Murakami). None of the wood was submitted for radiocarbon dating because it did not appear to derive from old deposits. It was thought that its identification could provide information about the vegetation that once grew in the project area.

Ceramics, Historic

Twelve pieces of historic ceramics were recovered (Table 2). Most were too small to provide information about the vessel form from which they originated (Photos 10-11). The most complete piece was the base of a probable rice bowl recovered from BT 9 (Photo 10, left). The footrim of this stoneware bowl has an exterior diameter of 41 mm and it is 9 mm high. The footrim exterior is trimmed with a blue band. Another blue band marks transition from the footrim to the lower portion of the wall which has a series of blue stenciled triangles near the base.

The piece is too small to provide an accurate estimate of the bowl's overall diameter and height. The bowl interior has a small central medallion with a blue floral design and a blue line which marks the point where the bowl walls meet the base (Photo 10, right). The diameter of this blue circle is 62 mm. According to local archaeologist and ceramic specialist, Lon Bulgrin (pers. comm. 2009), this type of stenciled stoneware was made in Japan during the period from 1880-1914. It is likely that it was brought to Guam by one of the Japanese trading vessels that operated in the Marianas during that time.

Table 2. Historic ceramics recovered from the project area.

Trench	Cat. No.	Description
BT 1	1	1 porcelain rim with 2 blue bands
BT 5	8	2 pieces of white stoneware, 1 stoneware handle with brown glaze, 1 rim from a Japanese porcelain rice bowl with blue, underglaze transfer print
BT 8	10	1 piece of creamware, perhaps a plate fragment
BT 9	11	1 stoneware bowl fragment with blue stenciled design
BT 9	12	2 pieces of Japanese porcelain with blue, underglaze transfer print, 1 piece of stoneware with green glaze
BT 10	13	1 piece of stoneware with brown exterior glaze, 1 creamware rim



Photo 10. Stoneware rice bowl from BT 9. The scale is 3 cm long. Left, footrim and exterior. Right, center medallion and interior.

The moist brown sandy clay of BT 5 yielded the greatest number of ceramics with four pieces. However, the ceramics in this deposit were mixed with plastic and other modern materials that had accumulated prior to the introduction of the quarried base course. It is likely that the entire area was mechanically cleared before the base course was laid. The clearing probably destroyed any houses or features that survived WWII, and mixed the upper portion of the deposit.

The three small porcelain pieces with blue transfer print designs on their surfaces (Photo 11) are likely to have derived from small rice bowls made in Japan. Fragments such as these are fairly common in Guam's archaeological deposits with an historic component. This type of bowl was probably imported to Guam from the late 1800s to as late as 1944.



Photo 11. Historic ceramic fragments. The scale is 3 cm long. Left side of photo: top, rim with blue band=BT 1, Layer II; middle, white piece=BT 8 back dirt; lower, two blue and one green piece=BT 9. Right side of photo: top, blue rim, brown handle, and two white pieces=BT 5; lower, brown and beige pieces=BT 10.

All of the ceramic pieces appear to derive from utilitarian objects including possible jars, bowls, plates, and cups (as indicated by the handle). The green piece may be from a decorative object such as a vase. No fine porcelain pieces were recovered. These items suggest that people were living near, or discarding their broken items in the vicinity of the SMP.

Ceramics, Traditional

Seven traditional pottery sherds were recovered, four from BT 1, two from BT 5, and one from BT 9 (Table 3).

Table 3. Count and weight of pottery sherds by backhoe trench and catalog number.

Trench	Catalog Number	Number	Weight (g)
BT 1	4	3	31.1
BT 1	5	1	24.2
BT 5	8	2	36.4
BT 7	9	1	3.4
Total		7	95.1

All seven sherds were analyzed in spite of the fact that some are badly eroded. Generally, sherds lacking intact surfaces are set aside and not included in an analysis, but because there are so few sherds in this collection, they were all analyzed. The seven sherds

include one thickened rim and six body sherds (Table 4). The analysis of temper inclusions was accomplished by observing a freshly broken section of each sherd with a binocular microscope equipped with a 10x lens. When green black, gray, and occasional white inclusions were noted, the sherd was classified as volcanic sand temper. No other temper categories were present. Based on temper content, all seven appear to date to the Latte Phase. Information about sherd thickness was obtained by measuring with calipers each sherd. Thickness values to the nearest millimeter were recorded. Generally the thickest part of the sherd was measured. No unusual characteristics were observed.

Table 4. Characteristics of the seven traditional sherds by trench and catalog number.

Trench	Catalog Number	Vessel Part	Surface Treatment	Temper Content	Thickness (mm)
BT 1	4	Wall	eroded	volcanic	11
	4	Wall	plain	volcanic	9
	4	Wall	plain	volcanic	6
BT 1	5	Rim	eroded	volcanic	10/ rim 16
BT 5	8	Wall	eroded, possibly combed	volcanic	11
BT 5	8	Wall	plain	volcanic	7
BT 7	9	Wall	eroded	volcanic	8

The surfaces of four sherds were eroded, but one of these may once have had a combed finish. Combing is closely associated with the Latte Phase. Three sherds have a plain finish. The plain surface treatment occurs throughout Guam's pottery sequence, thus it doesn't help to place a single sherd in a temporal context. All seven sherds have volcanic sand temper. The volcanic sand temper category is generally associated with the Latte Phase. The thickness of the sherds ranges from 6-11 mm with a mean thickness of 8.8 mm. The thickness values also suggest that the sherds date to the Latte Phase. The rim thickness of the one rim sherd is 16 mm. Rims with similar thickness values are closely associated with the Latte Phase.

The various characteristics of these sherds, taken together, indicate that they probably date to the Latte Phase. The eroded condition of more than half of them suggests that erosion and/or storm generated waves have affected the area in the past. The intermittently wet conditions may have made the SMP area less attractive or less suitable for permanent habitation prior to European Contact.

Faunal Remains

Marine Mollusks

Although no intact cultural deposits and no shell middens were encountered during the excavation of the backhoe trenches, marine mollusk shells were collected opportunistically, because they provide information about the environment.

The most common shells are *Gafrarium tumidum* and *Anadara antiquata*. Both are bivalve species that live in or near mangroves. It is very likely that there were mangroves at the mouth of the Masso River in the past. Mangroves occur now within Apra Harbor and also at

Cocos Lagoon at the southern end of Guam, but they were more widespread in the past (Amesbury 2007). The sea level decline, which has occurred within the last 4,000 years, caused the demise of mangroves in other parts of Guam.

Backhoe Trenches 1, 5, and 9 yielded *Gafrarium tumidum*, while BT 2, 5, and 9 yielded *Anadara antiquata*. Shells of both species can also be seen on the present-day beach. Other marine shells collected are *Spondylus* sp., *Cypraea* sp., *Lambis* sp., and *Strombus mutabilis* from BT 5, *Terebra maculata* from BT 8, and *Scutarcopagia scobinata* and *Cypraea* sp. from BT 12.

The late Sister Antoinette, who worked and resided at Notre Dame High School in Talofofo, was interviewed in 1996, and she remembered that there were many bivalves in the Piti area before WW II. Sister Antoinette was born in 1911, and lived with her family in Hagatna until her father bought land in Talofofo in the 1920s. Sister Antoinette said that people came from Piti to Hagatna carrying sacks of bivalves to sell. Her family bought those when they lived in Hagatna.

Other Invertebrates

Many pieces of coral were seen in the dredged fill, but not collected. A fragment of a sea urchin test (Class Echinoidea) was collected from BT 5.

Vertebrates

Three pieces of non-human bone were collected. Bone fragments of unidentified vertebrates were recovered from BT 5 and BT 9. Weight of the fragment from BT 5 is 2.2 grams; weight of the fragment from BT 9 is 7.4 grams.

From BT 8 is a piece of long bone from a large mammal, which has butcher marks on it. The bone fragment weighs 18.2 grams.

Glass

Eight pieces of glass were collected; seven appear to derive from bottles. One clear, thin fragment may be from a light bulb. The pieces of glass were collected from BT 5 (4 brown and 1 clear piece probably from the light bulb), BT 9 (2 green) and BT 10 (1 brown). The seven pieces of bottle glass were from the bottle body, thus they lack diagnostic characteristics such as closures and base markings that could help to date them. None had other markings or surface embossures. However, the surfaces of the pieces have not deteriorated which suggests that they have not been in the ground for extended periods of time.

Lithics

A slab of pale green tuffaceous sandstone (Cat. No. 3) was recovered from the brown clay of BT 1 (Photo 12). The slab is roughly trapezoidal. The two non-parallel sides measure 25 cm, while the two parallel sides measure 20 cm and 6 cm. Thickness of the slab varies from 19.3

to 28.7 mm, and weight is 4 pounds 12 ounces. The slab may have been shaped by a person. The two long sides appear to be shaped and or smoothed.



Photo 12. Slab of green tuffaceous sandstone from BT 1. The scale is 15 cm long.

Two small pieces of the same pale green tuffaceous sandstone (Cat. No. 8) were collected from BT 5. They weigh 25.3 and 8.1 grams. Also from BT 5 is an unworked piece of andesite (Cat. No. 8) weighing 53.3 grams.

Outcrops of the green tuffaceous material occur in the Alutom Formation which is found in the inland hills in the vicinity of Asan and Piti and south to Talefac (Tracey et al. 1964:A15). Occasionally small pieces of this material are found in archaeological deposits elsewhere on Guam, but since the material usually appears unmodified, descriptions are not always included in the reports (Moore et al. 1993). Former Governor Olive (1984:18), who described the minerals found on Guam, indicates that there was a light green clay rock, called *Lauca*, with a soft fine grain that could be easily worked; it was used for all types of gravestones in the late 1800s. That description seems to fit the tuffaceous sandstone material. While the slab pictured above appears to have been shaped, it did not mark a grave in BT 1. The origin of the term *lauca* is unclear.

The word was not found in the Chamorro dictionary (Topping et al. 1975) or in an on-line Spanish dictionary.

Pieces of coal were recovered from three backhoe trenches, BT 7, 11, and 12 (Cat. No. 9, 14, and 15). The two pieces from BT 7 weigh 39.4 and 2.8 grams. The piece from BT 11 weighs 27.8 grams, and the piece from BT 12 weighs 21.2 grams. The coal probably came from the coal station on Cabras Island.

What appears to be a piece of graphite was collected from the brown clay of BT 9 (Cat. No. 12). The soft black lustrous material is cylindrical. Diameter is 0.8 cm and length is 2.2 cm.

Metal

A copper strip was recovered from the BT 5 back dirt. It is 17 cm long, 15 mm wide, and 1 mm thick with a nail hole at one end. An aluminum pull tab from a beverage can was recovered from BT 7 back dirt. A nail was recovered from BT 10 back dirt.

Wood Identification

Three wood samples were sent to Gail Murakami, International Archaeological Research Institute, Inc. in Honolulu for identification (Appendix B). The samples were recovered from BT 4 (Cat. No. 7), BT 8 (Cat. No. 10) and BT 9 (Cat. No. 12). It is likely that the wood samples in BT 4 and BT 8 entered the clay soils when the area was cleared of vegetation prior to the introduction of the fill material. The wood from BT 4 was identified as an unknown palm. The wood from BT 8 was identified as *tangan-tangan*, or possibly a similar type of legume shrub/tree. The wood from BT 9 was identified as pine or fir that could have been introduced to Guam as a shipping pallet or container, wooden utility pole, or lumber for construction. All three examples are possibilities. Since BT 9 was near the old road, the wood could have come from a wooden utility pole that had been adjacent to the road. Since the area served as a storage yard during WWII, the wood could have come from imported lumber that had been stored there. The samples were not radiocarbon dated since they did not appear to date to prehistoric or early historic times.

SUMMARY AND DISCUSSION

While a fairly wide range of material categories was recovered from the SMP project, the items were mostly historic and they probably date to WWII or the First American Period. Generally the items derived from deposits that contained a mixture of material dating from the two time frames. The mixing of the historic materials may be due to mechanical clearing and/or leveling that took place prior to the introduction of the fill material. Only a few prehistoric pottery sherds were recovered, and due to their eroded conditions, it was thought that they could have originated elsewhere and been transported to the deposit by water action. However, they indicate that people were in the vicinity of SMP during the Latte Phase.

The historic ceramic fragments indicate that people in the vicinity of the project area were serving food; no cooking pieces were identified. The cup handle, glass fragments, and the

aluminum pull tab suggest that people consumed beverages in the vicinity previously, as they do today.

The marine shells that were collected may occur in the deposits naturally since many of the same species were also seen on the present beach. No shell middens were identified in the trenches, but it is possible that some of the shells were discarded by collectors after beachside barbecues or other collecting events. The butchered bone could have been the result of a barbecue event.

Little evidence was found to suggest that the area was utilized to any extent during prehistoric times. While the few pottery sherds that were recovered indicate that people were in the vicinity, apparently they were not living on this beach. No fire-features or stone or shell tools were seen. Perhaps this beach was too wet or supported mangroves or other vegetation which made it unsuitable for habitation during the Latte Phase.

Archival review suggests that there may have been houses in the vicinity during the First American Period, however no structural remains were identified during the testing. Possibly mechanical clearing of the area removed these features if they did exist.

RECOMMENDATIONS

While the backhoe testing found no significant historic properties in a subsurface context, the following recommendation for further archaeological work is provided, based on the soils exposed in the test trenches, and because of the possibility, although rare, that historic properties could exist in untested portions of SMP.

- 1) Design the park renovations so that areas below the layers of introduced fill material are not disturbed. Generally, the upper two feet of the main part of the project area consist of fill and this material appears to provide a good base for the proposed parking lot, playground, trail and other improvements.
- 2) There is no introduced fill material in the area by the beach pavilion and toward the river. Land alterations in this vicinity should be monitored by an archaeologist, or left undisturbed.
- 3) Construction work in the vicinity of the basketball court, where the backfill is likely to be most extensive, is not likely to disturb the intact clays below the fill and should require no archaeological monitoring. In other words, the demolition of the court's slab and the construction of a large pavilion, or other structures in its place, are not expected to impact significant cultural properties.
- 4) It is likely that the restroom facility is built on quarried fill material also, however if the restroom is going to be connected to the existing sewerline, that trenching should be monitored by an archaeologist, if it is to be deeper than the introduced fill.
- 5) Likewise, if the old septic tank is going to be replaced or a new one dug, the related excavations should be monitored by an archaeologist.

The final recommendation is to complete a detailed documentation of the old bridge and roadbed that are present in the southwest portion of the project area and to erect a barricade or cover the slumped area by the bridge to prevent people from falling into the cavity.

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APPENDIX A

Field Catalog

SANTOS MEMORIAL PARK

FIELD CATALOG

Cat. No.	Provenience	Items	Date
01	BT 1, dark brown clay	Historic ceramic, <i>Gafrarium tumidum</i> shell	12/01/08
02	BT 1, black clay	Soil sample	12/01/08
03	BT 1, brown clay	Slab of green tuffaceous sandstone	12/01/08
04	BT 1, brown clay	Four pottery sherds	12/01/08
05	BT 1, brown clay	Pottery sherd shown on profile of BT 1	12/01/08
06	BT 2 back dirt	<i>Anadara antiquata</i> shell	12/01/08
07	BT 4, 135-170 cmbs	Wood sample	12/01/08
08	BT 5, back dirt	Glass, metal, historic ceramics, stone, bone, shell	12/01/08
09	BT 7, back dirt	Pottery sherd, metal, coal	12/01/08
10	BT 8, back dirt	Historic ceramic, wood, butchered bone, <i>Terebra maculata</i> shell	12/02/08
11	BT 9, brown clay, 44 cmbs	Historic ceramic	12/02/08
12	BT 9, brown clay, back dirt	Glass, historic ceramics, wood, bone, shell	12/02/08
13	BT 10, back dirt	Glass, nail, historic ceramics	12/02/08
14	BT 11, fill	Coal	12/02/08
15	BT 12, back dirt	Coal, marine shells	12/02/08

APPENDIX B

Wood Identification

by

Gail Murakami

International Archaeological Research Services, Inc.

Honolulu, Hawaii

Table 1. Summary of Wood Identifications from Santos Memorial Park, Guam.

Cat. No.	Backhoe Trench	Depth, cm bs	WIDL #	Taxa	Common Name	Habit/ Origin	Comments
7	4	135-170	0901-1	Arecaceae	Palm	Tree	
10	8	66-135	0901-2	cf. Leguminosae	Legume?	Tree-shrub	Not identified, but appears not to be common historical introductions such as <i>tangantangan</i> .
12	9	36-70	0901-3	cf. Pinaceae	Pine, fir	Tree/Historical introduction-lumber	Has anatomy resembling members of the pine family but most closely resembles the genus <i>Pseudotsuga</i> which includes Douglas fir, Oregon pine, used for building and construction (lumber, plywood) as well as telegraph poles, railroad ties.

APPENDIX B ARCHITECTURAL DESIGN DRAWINGS

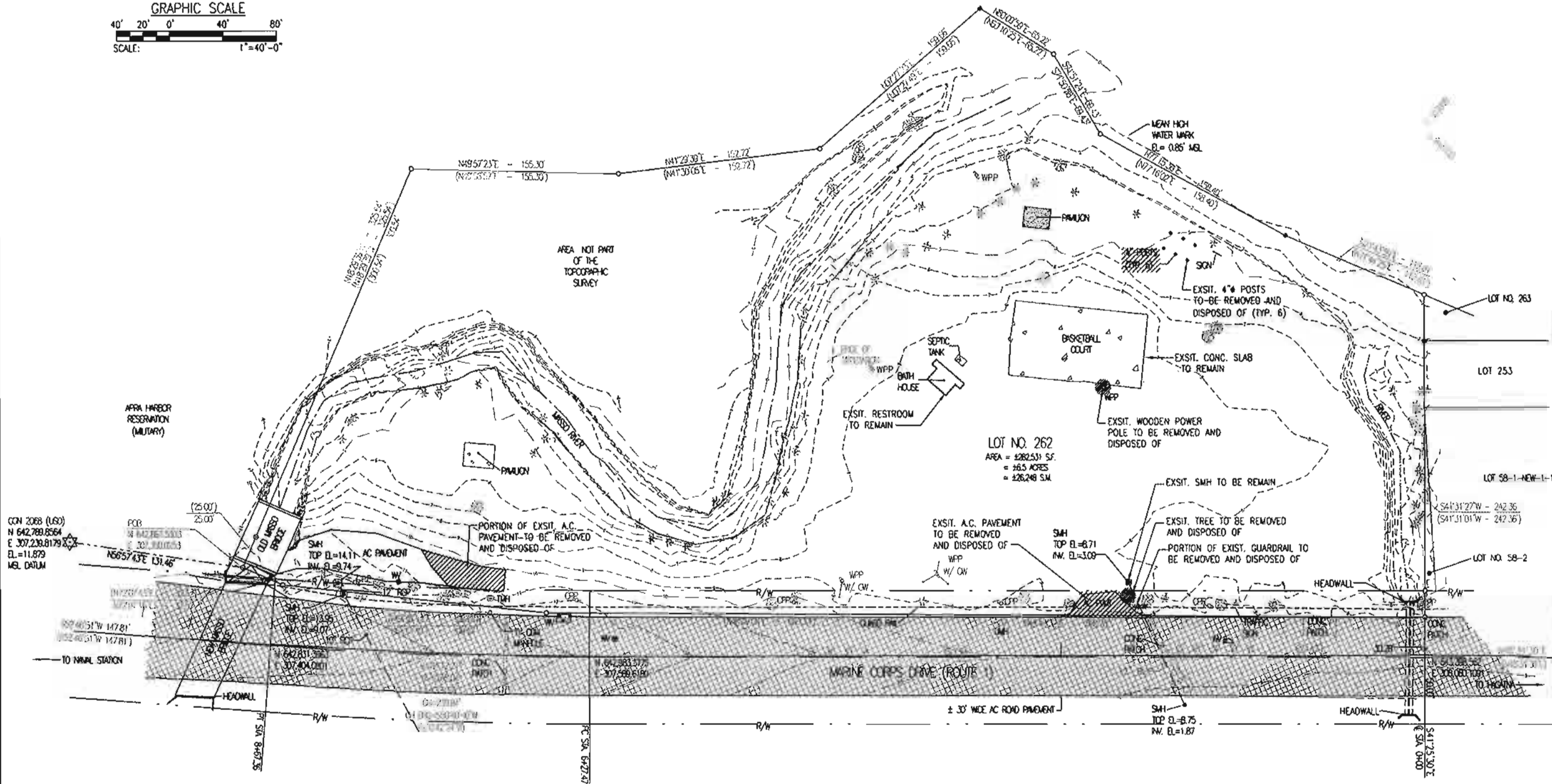
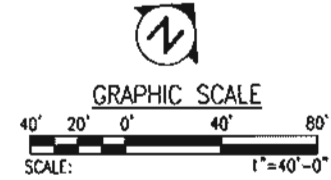


CENTRAL PAVILLION = 1,000 SF
 GAZEBO 2 @ 300 SF = 600 SF
 TRELLIS 3 @ 300 SF = 900 SF



APPENDIX C

ARCHITECTURAL/CIVIL CONCEPTUAL DESIGN DRAWINGS



CONSULTANTS



I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.
DATE: _____

PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS
"SANTOS MEMORIAL PARK"
MUNICIPALITY OF P.O. GUAM

CLIENT:
DEPARTMENT OF PUBLIC WORKS

MARK	DATE	DESCRIPTION
PROJECT NO.:	???	
CAD DWG FILE:	SANTOS-C1.DWG	
DATE:	FEB. 2009	
DRAWN BY:	JMC/JJD	
CHECKED BY:	EMS	
SUPV. BY:	EMS	

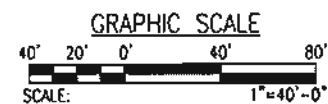
SHEET TITLE

EXISTING CONDITION
AND
DEMOLITION PLAN

C-1

SHEET 1 OF 2

1 EXISTING CONDITION AND DEMOLITION PLAN
SCALE: 1"=40'-0"



CONSULTANTS



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BY ME OR UNDER MY DIRECT SUPERVISION.
DATE: _____

PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS
"SANTOS MEMORIAL
PARK"
MUNICIPALITY OF PITL GUAM

CUSTOMER: DEPARTMENT OF PUBLIC WORKS

MARK	DATE	DESCRIPTION
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DATE :		FEB. 2009
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SUPV. BY:		EMS

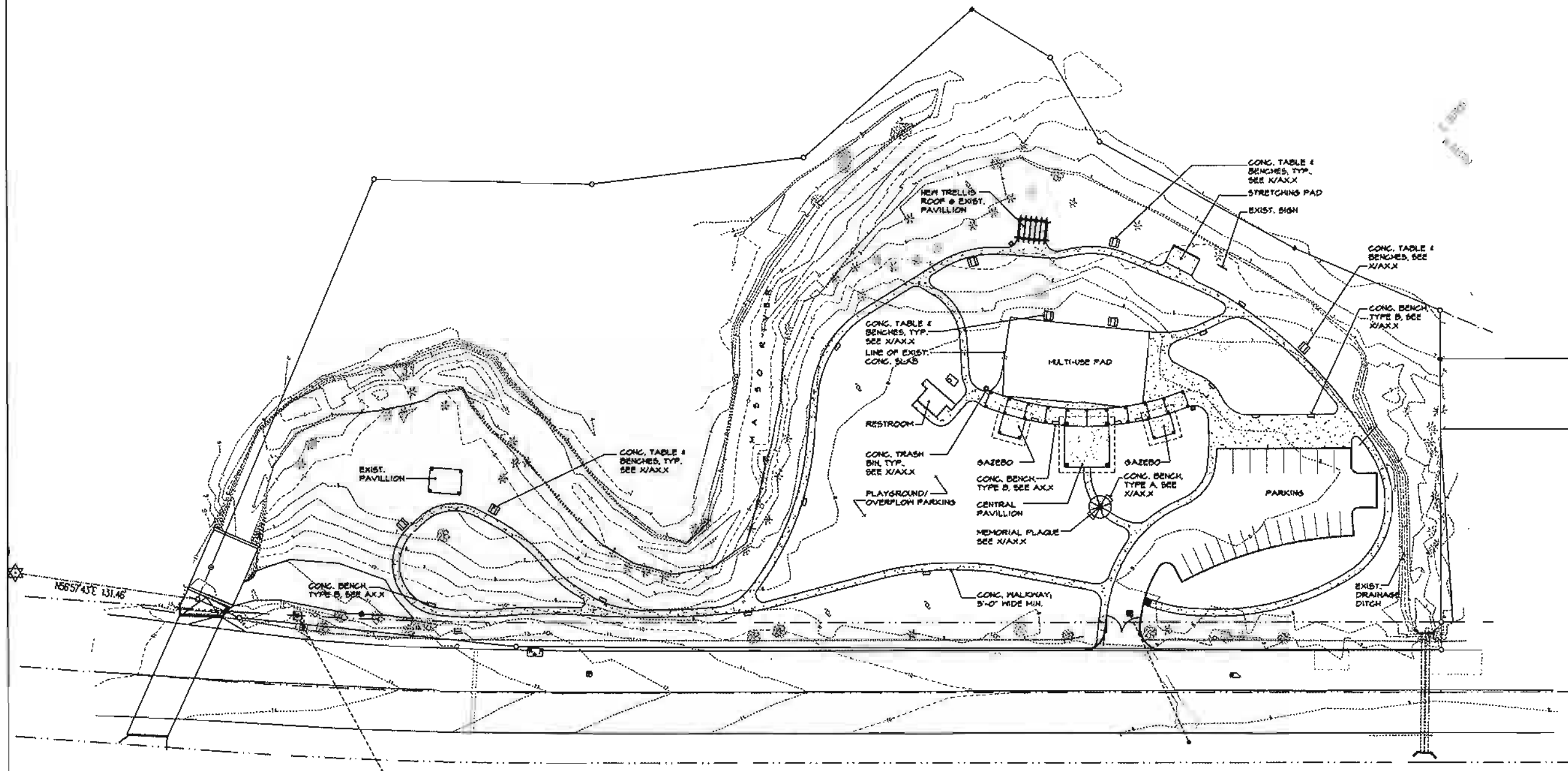
SHEET TITLE

SITE IMPROVEMENTS PLAN

C-2

SHEET 2 OF 2

1 SITE IMPROVEMENTS PLAN
SCALE: 1"=40'-0"



1 ARCHITECTURAL SITE PLAN

SCALE:

1" = 40'-0"



CONSULTANTS

TRMA

Taniguchi Ruth Maki Architects
180 Cliff Business Center, P.O. Box 14, Igoua, CO 80630
Tel: (871) 475-8772 • Fax: (871) 472-3381

Architecture
Planning
Interior Design

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PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS

"SANTOS MEMORIAL
PARK"

MUNICIPALITY OF PUL GUM

CLIENT:

DEPARTMENT OF PUBLIC WORKS

MARK	DATE	DESCRIPTION
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CAD DWG FILE:		
DATE:	FEB. 2009	
DRAWN BY:	RC	
CHECKED BY:	EMS	
SUPV. BY:	EMS	

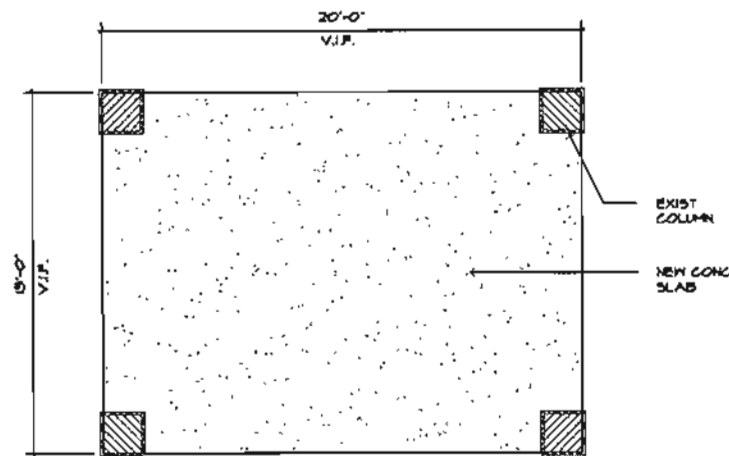
SHEET TITLE

ARCHITECTURAL
SITE PLAN

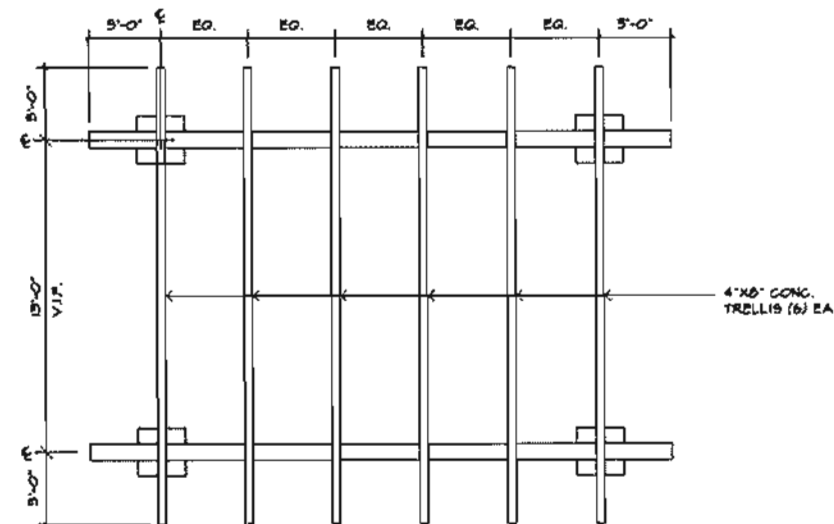
A1-0

SHEET OF ?

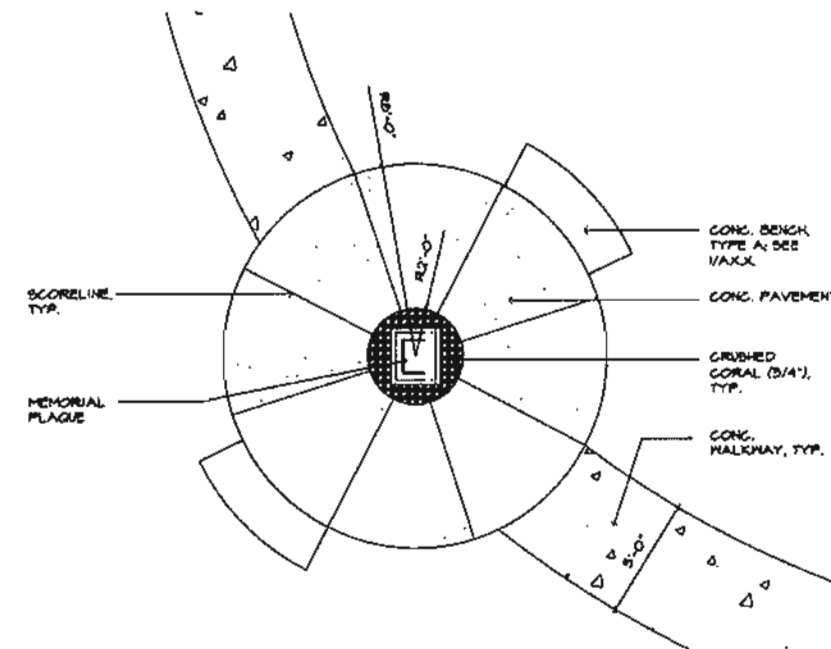




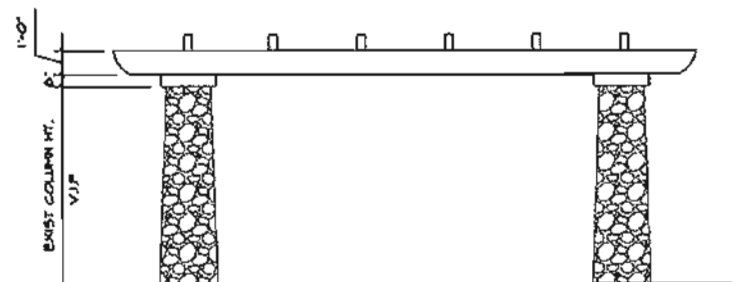
1 ENLARGED PLAN - EXIST. NORTH PAVILLION
SCALE: 1/4"=1'-0"



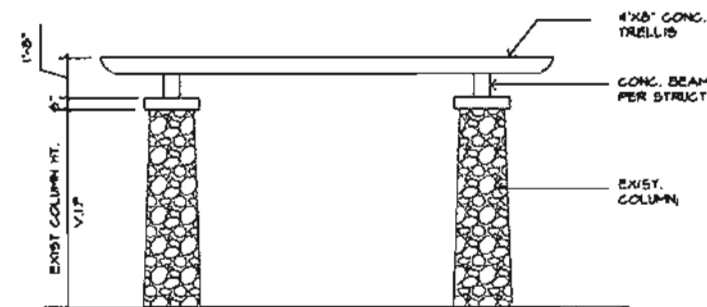
2 ROOF PLAN - EXIST. NORTH PAVILLION
SCALE: 1/4"=1'-0"



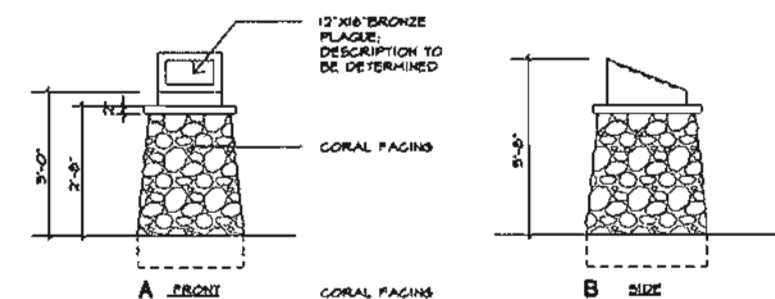
3 ENLARGED PLAN - MEMORIAL PLAZA
SCALE: 1/4"=1'-0"



4 ELEVATION
SCALE: 1/4"=1'-0"



5 ELEVATION
SCALE: 1/4"=1'-0"



6 ELEVATION
SCALE: 1/2"=1'-0"

CONSULTANTS

TRMA 88

Taniguchi Ruth Makio Architects
100 East Business Center, P.O. Box 84, Igou, CO 80118
Tel: (303) 478-8778 • Fax: (303) 472-3381

Architecture
Planning
Interior Design



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DATE: _____

PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS

"SANTOS MEMORIAL
PARK"
MUNICIPALITY OF PTL, GUAM

CLIENT:
DEPARTMENT OF PUBLIC WORKS

MARK DATE DESCRIPTION

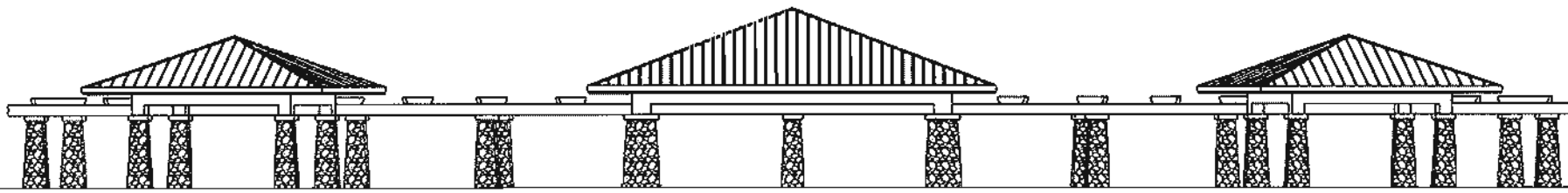
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CAD DWG FILE:
DATE: FEB. 2009
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SUPV. BY: EMS

SHEET TITLE

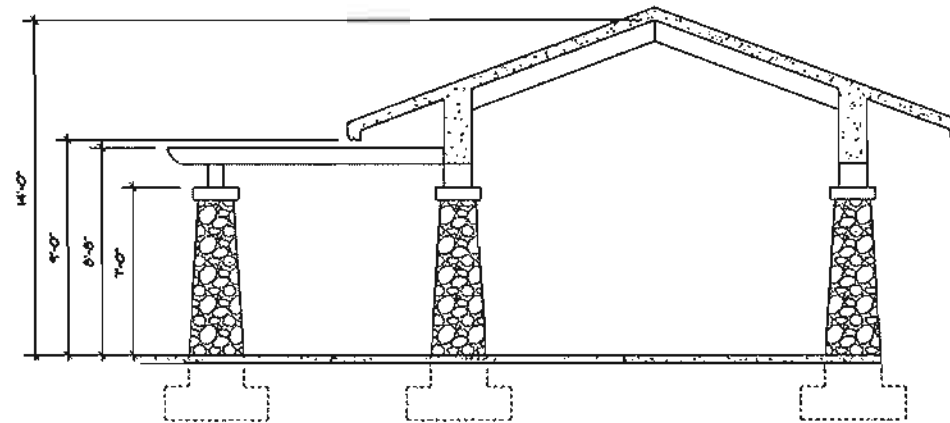
ENLARGED PLAN--EXIST. NORTH
PAVILLION, ROOF PLAN--EXIST.
NORTH PAVILLION, ENLARGED
MEMORIAL PLAZA, ELEVATIONS

A1-2

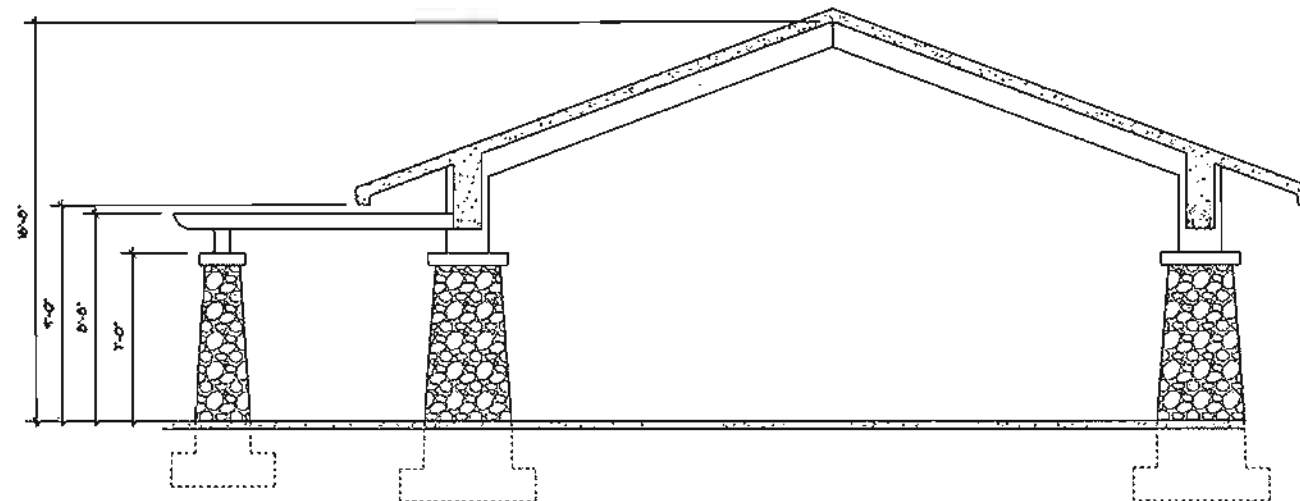
SHEET XX OF ?



1 ELEVATION
SCALE: 1/8"=1'-0"



2 SECTION
SCALE: 1/4"=1'-0"



3 SECTION
SCALE: 1/4"=1'-0"

CONSULTANTS

TRMA

Taniguchi Ruth Makio Architects
140 Oak Meadows Court, P.O. Box 14, Igoua, CO 80619
Tel: (671) 475-8772 • Fax: (671) 472-3381

Architecture
Planning
Interior Design



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BY ME OR UNDER MY DIRECT SUPERVISION.
DATE: _____

PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS

"SANTOS MEMORIAL
PARK"

MUNICIPALITY OF PTL, QUW

CLIENT:
DEPARTMENT OF PUBLIC WORKS

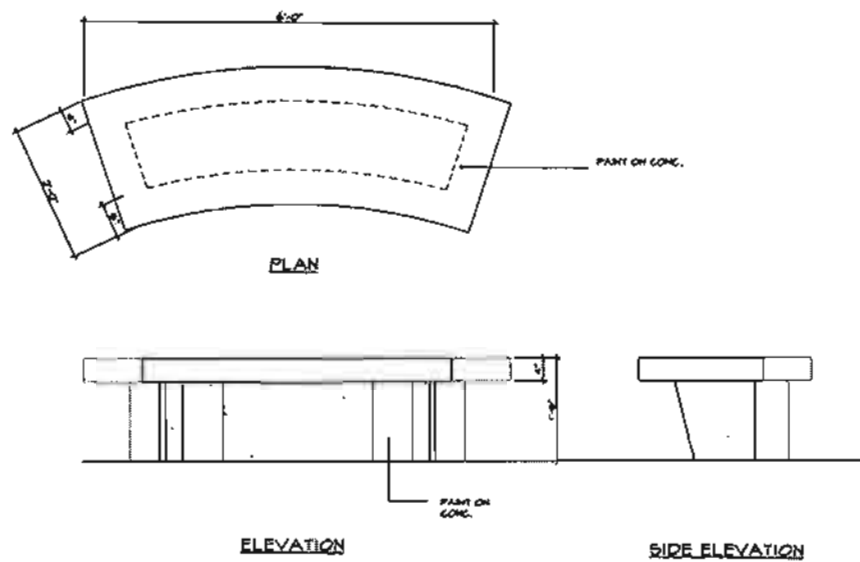
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PROJECT NO:	XXXXXXXX	
CAD DWG FILE:		
DATE :	FEB. 2009	
DRAWN BY:	RC	
CHECKED BY:	EMS	
SUPV. BY:	EMS	

ELEVATION & SECTIONS
CENTRAL PAVILION & GAZEBOS

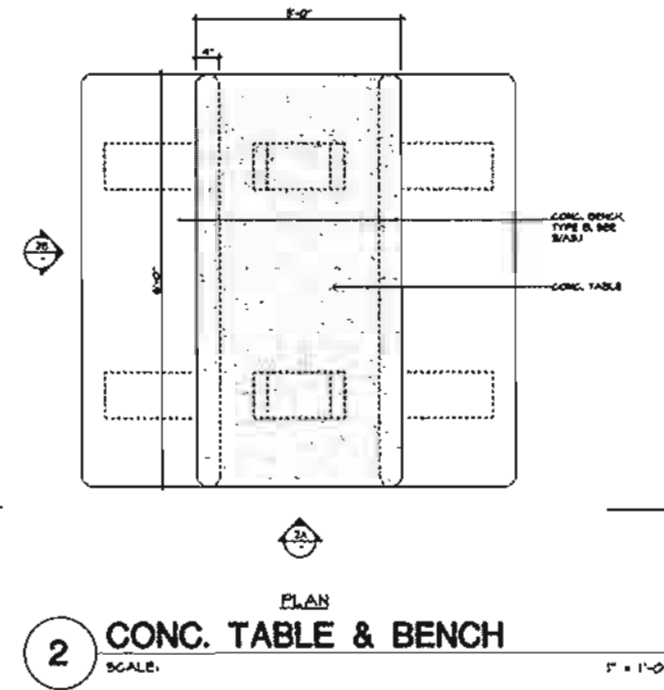
A2-1

XX

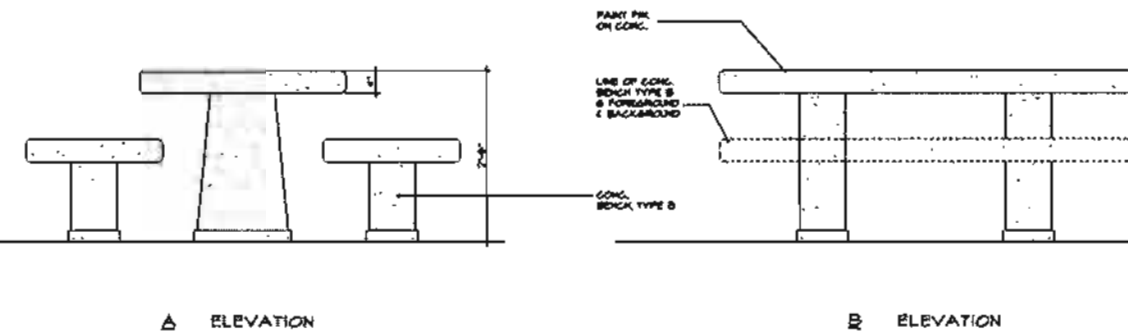
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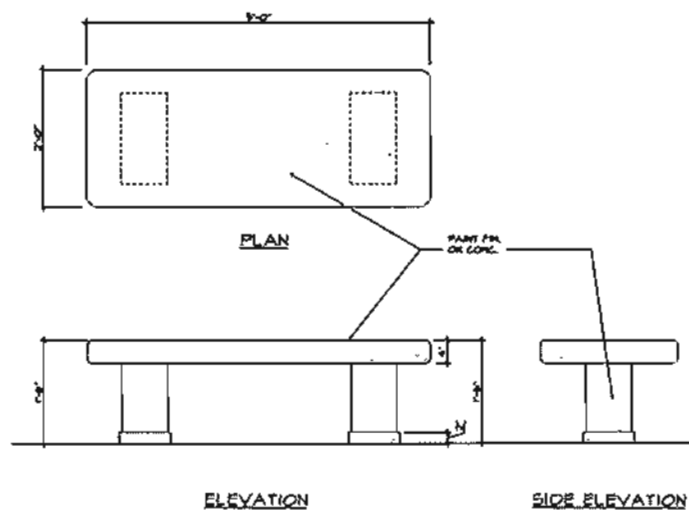
1 BENCH - TYPE A
SCALE: 1" = 1'-0"



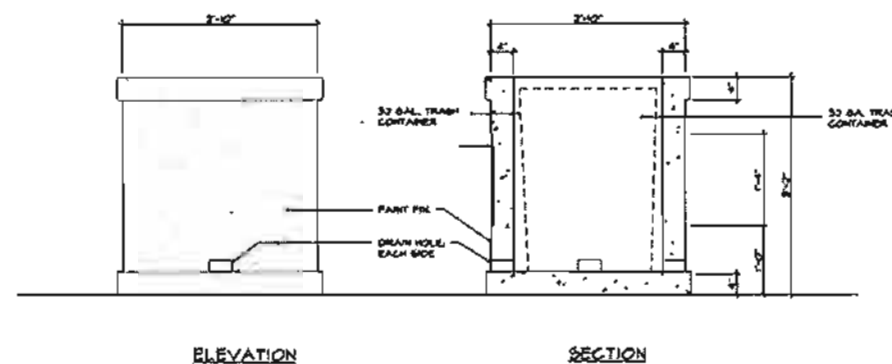
2 CONC. TABLE & BENCH
SCALE: 1" = 1'-0"



B ELEVATION



3 TRASH BIN - TYPE B
SCALE: 1" = 1'-0"



4 TRASH BIN - TYPE B
SCALE: 1" = 1'-0"



CONSULTANTS

TRMA88

Taniguchi Ruth Makio Architects
10000 Business Center, P.O. Box 11, Irvine, CA 92618
Tel: (949) 475-8772 • Fax: (949) 475-8773

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Planning
Interior Design



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BY ME OR UNDER MY DIRECT SUPERVISION.
DATE: _____

PROJECT TITLE

DEPARTMENT OF
PUBLIC WORKS

"SANTOS MEMORIAL
PARK"
MUNICIPALITY OF PIT, CALIF.

CLIENT:
DEPARTMENT OF PUBLIC WORKS

MARK	DATE	DESCRIPTION

PROJECT NO:	XXXXXXXX
CAD DWG FILE:	
DATE:	FEB. 2009
DRAWN BY:	RC
CHECKED BY:	EMS
SUPV. BY:	EMS

SHEET TITLE

SITE AMMENITIES
DETAILS

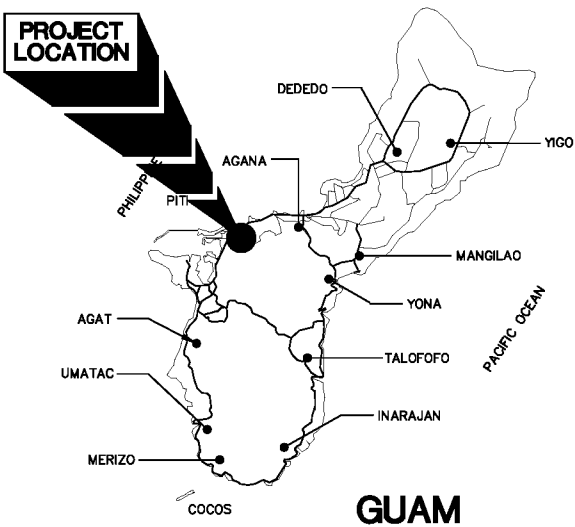
A3.1

SHEET XX OF ?

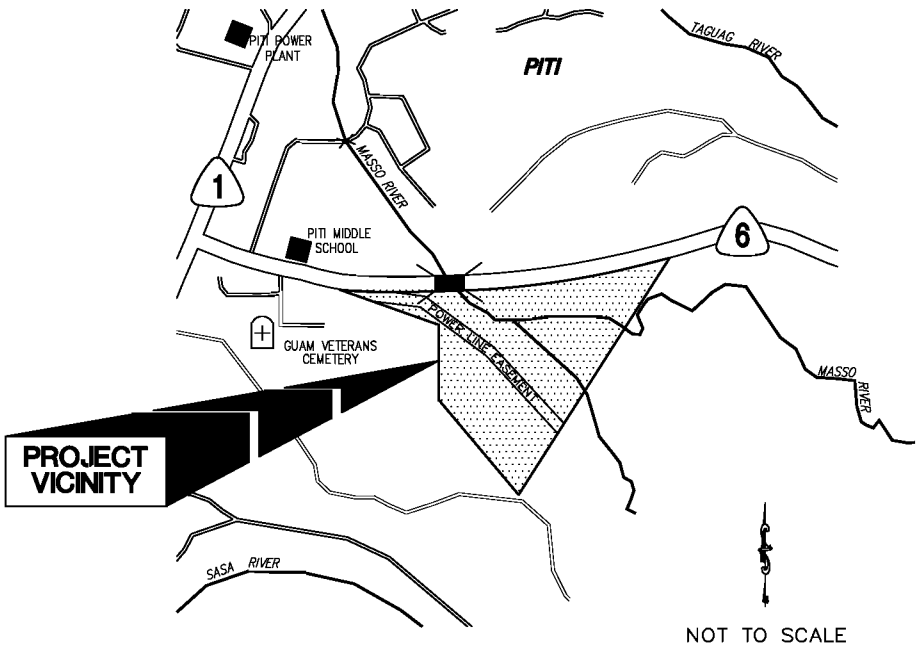
APPENDIX C MASSO RESERVOIR REHABILITATION DESIGN DRAWINGS

MASSO RESERVOIR REHABILITATION

LOCATION



VICINITY



INDEX OF DWGS.

DWG. NO.	SHT NO. OF NO.	SHEET CONTENT
TS-1	1 OF 24	TITLE, LOCATION MAP, VICINITY MAP, INDEX OF DRAWINGS, SURVEY NOTES, AND GENERAL NOTES
C-0	2 OF 24	GENERAL SITE DEVELOPMENT PLAN
C-1	3 OF 24	EXISTING CONDITIONS
C-2	4 OF 24	EXISTING CONDITIONS
C-3	5 OF 24	SITE AND GEOMETRIC PLAN
C-4	6 OF 24	SITE AND GEOMETRIC PLAN
C-5	7 OF 24	GRADING, DRAINAGE, & UTILITIES PLAN
C-6	8 OF 24	GRADING, DRAINAGE, & UTILITIES PLAN
C-7	9 OF 24	NATURE TRAILS PLAN
C-8	10 OF 24	FLOATING DOCK ACCESS & COFFER DAM DETAIL
C-9	11 OF 24	CROSS SECTIONS
C-10	12 OF 24	* MISCELLANEOUS DETAILS
C-11	13 OF 24	FISHING PLATFORM DETAIL
C-12	14 OF 24	FLOATING DOCK ACCESS DETAIL
C-13	15 OF 24	ROAD CENTERLINE PROFILE
C-14	16 OF 24	15'x15' PAVILION
C-15	17 OF 24	10'x10' PAVILION
C-16	18 OF 24	RESTROOM DETAILS
C-17	19 OF 24	* MISCELLANEOUS DETAILS
C-18	20 OF 24	SEPTIC TANK AND LEACHING FIELD DETAILS
C-19	21 OF 24	FLOATING DOCK DETAILS
C-20	22 OF 24	SPILLWAY DETAILS
C-21	23 OF 24	* MISCELLANEOUS DETAILS
C-22	24 OF 24	* MISCELLANEOUS DETAILS

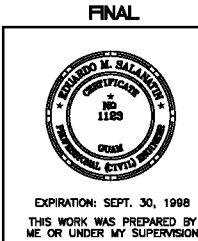
GENERAL NOTES

1. THE CONTRACTOR SHALL VISIT THE PROJECT SITE PRIOR TO THE BIDDING TO DETERMINE THE NATURE AND EXTENT OF WORK REQUIRED.
2. THE FINISH GRADE INDICATED HEREON SHALL MATCH OR CONNECT TO SURROUNDING AREA AS SHOWN ON THE GRADING PLANS. IN THE EVENT THE CONTRACTOR DISCOVERS ANY ERROR OR DISCREPANCY, HE/SHE SHALL IMMEDIATELY NOTIFY THE CONTRACTING OFFICER FOR DECISION.
3. THE CONTRACTOR SHALL DISPOSE OF ALL DEBRIS AND TRASH TO THE APPROVED LANDFILL SITE, OR APPROVED DISPOSAL AREA DESIGNATED BY THE CONTRACTING OFFICER. THE CONTRACTOR SHALL COMPLY WITH ALL THE REQUIREMENTS PERTAINING TO THE USE OF THE DISPOSAL AREA.
4. ALL STRUCTURES OR OBSTRUCTIONS AT THE PROJECT SITE THAT ARE TO BE DEMOLISHED SHALL BE REMOVED AS ORDERED BY THE CONTRACTING OFFICER AND TRANSPORTED TO THE DESIGNATED AND APPROVED DISPOSAL AREA.
5. PRIOR TO EXCAVATING FOR NEW SEWER OR OTHER UTILITY LINES THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATION OF EXISTING UTILITIES AND ASSOCIATED COMPONENTS.
6. THE EXISTENCE AND LOCATION OF EXISTING UNDERGROUND UTILITIES AND STRUCTURES SHOWN ON THE PLANS ARE FROM THE LATEST AVAILABLE DATA BUT IS NOT GUARANTEED AS TO ITS ACCURACY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING THESE EXISTING UTILITIES.
7. FOR ACTUAL LOCATION OF DREAGE MATERIALS AND EXCESS SUITABLE MATERIALS FROM THE PROJECT SITE, THE CONTRACTOR SHALL COORDINATE WITH THE CONTRACTING OTHER.

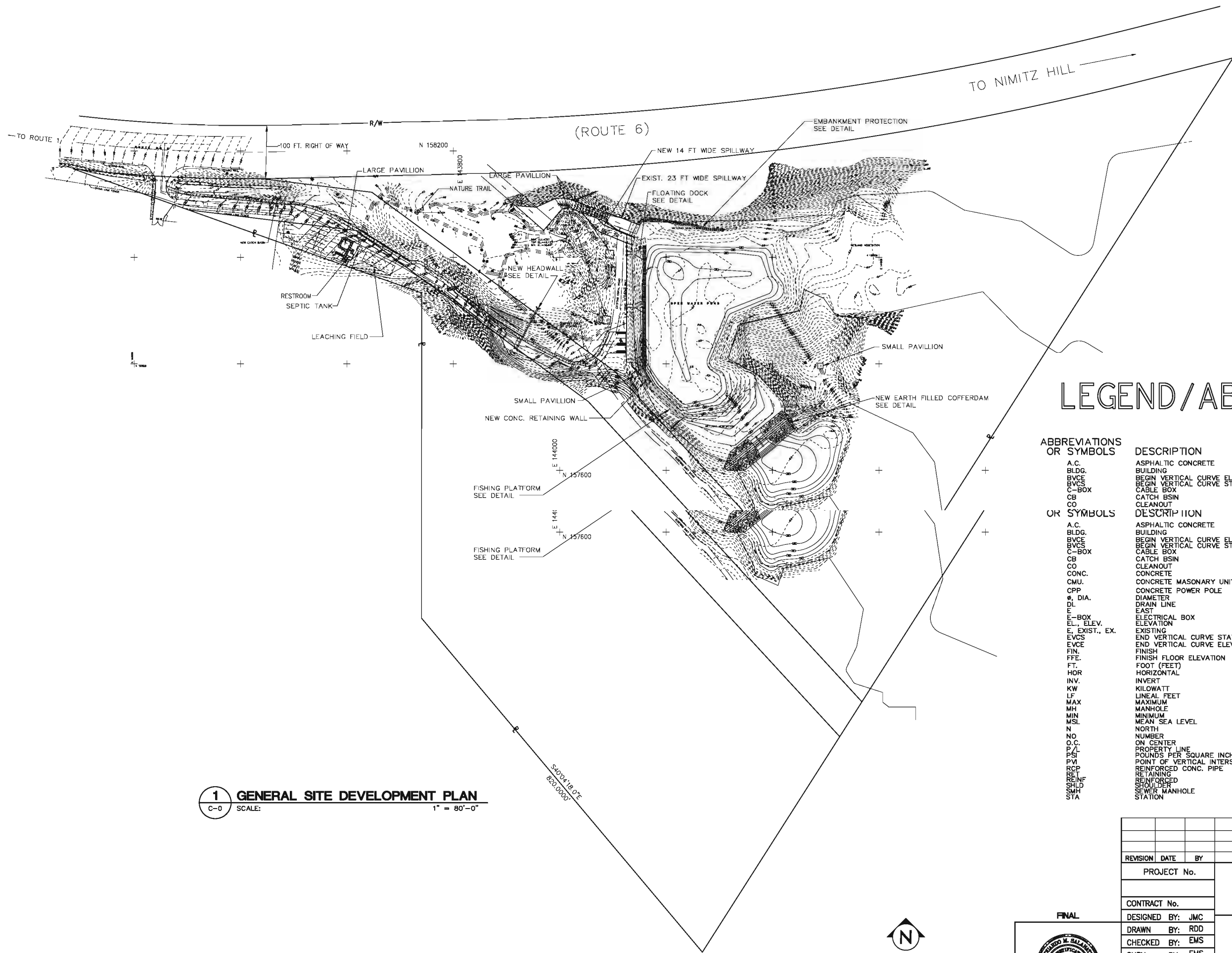
SURVEY NOTES

1. HORIZONTAL AND VERTICAL CONTROL SURVEY WAS BASED ON THE 1963 GRID VALUE. SHOWN ON SHEET C-2 MARK RP-1 AND RP-2.

MARK	NORTHING	EASTING	ELEVATION
RP-1	157889.32	144126.01	64.82'
RP-2	158026.11	144126.36	64.65'
2. CONTOURS WERE DEVELOPED FROM SPOT ELEVATIONS USING GROUND TOPOGRAPHIC METHOD.
3. ALL DISTANCES, DIMENSIONS, COORDINATES AND ELEVATIONS ARE IN FEET AND DECIMALS THEREOF.



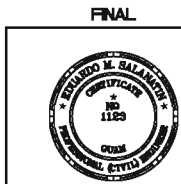
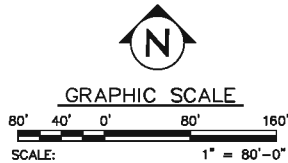
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CONTRACT No.			TITLE, LOCATION MAP, VICINITY MAP, INDEX OF DRAWINGS, SURVEY NOTES, AND GENERAL NOTES	
DESIGNED BY: JMC			RECOMMENDED BY:	
DRAWN BY: JMC			CHIEF OF ENGINEERING	
CHECKED BY: EMS			DATE	
SUPV. BY: EMS			DRAWER	
PROJECT ENGINEER			DRAWING NUMBER	
SECTION MANAGER			TS-1	
SCALE: NONE			SHEET 10F 24	



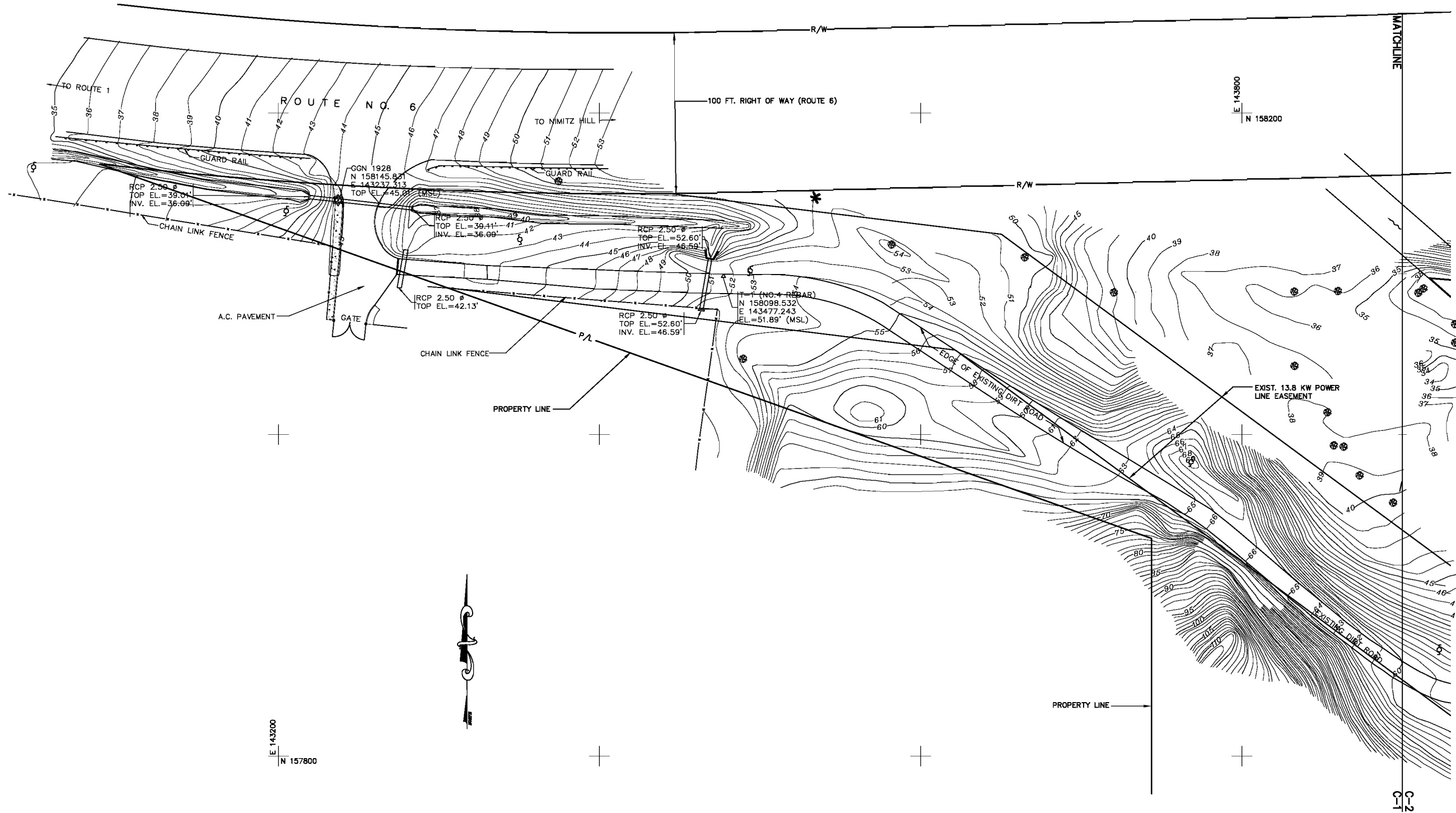
1 GENERAL SITE DEVELOPMENT PLAN
C-0 SCALE: 1" = 80'-0"

LEGEND / ABBREVIATIONS

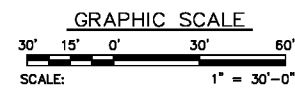
ABBREVIATIONS OR SYMBOLS	DESCRIPTION	ABBREVIATIONS OR SYMBOLS	DESCRIPTION
A.C.	ASPHALTIC CONCRETE	TYP.	TYPICAL
BLDG.	BUILDING	W/	WITH
BVCE	BEGIN VERTICAL CURVE ELEVATION	WL	WATERLINE
BVCS	BEGIN VERTICAL CURVE STATION	WV	WATER VALVE
C-BOX	CABLE BOX	WWF	WELDED WIRE FABRIC
CB	CATCH BASIN	WV	EXIST. CATCH BASIN
CO	CLEANOUT	WV	DESCRIPTION
CONC.	CONCRETE	WV	TYPICAL
CMU	CONCRETE MASONRY UNIT	WV	WITH
CPP	CONCRETE POWER POLE	WV	WATERLINE
Ø, DIA.	DIAMETER	WV	WATER VALVE
DL	DRAIN LINE	WV	WELDED WIRE FABRIC
E	EAST	WV	EXIST. CATCH BASIN
E-BOX	ELECTRICAL BOX	WV	DESCRIPTION
EL., ELEV.	ELEVATION	WV	TYPICAL
E, EXIST., EX.	EXISTING	WV	WITH
EVCS	END VERTICAL CURVE STATION	WV	WATERLINE
EVCE	END VERTICAL CURVE ELEVATION	WV	WATER VALVE
FIN.	FINISH	WV	WELDED WIRE FABRIC
FFE	FINISH FLOOR ELEVATION	WV	EXIST. CATCH BASIN
FT. (FEET)	FOOT (FEET)	WV	DESCRIPTION
HOR.	HORIZONTAL	WV	TYPICAL
INV.	INVERT	WV	WITH
KW	KILOWATT	WV	WATERLINE
LF	LINEAL FEET	WV	WATER VALVE
MAX	MAXIMUM	WV	WELDED WIRE FABRIC
MH	MANHOLE	WV	EXIST. CATCH BASIN
MIN	MINIMUM	WV	DESCRIPTION
MSL	MEAN SEA LEVEL	WV	TYPICAL
N	NORTH	WV	WITH
NO	NUMBER	WV	WATERLINE
O.C.	ON CENTER	WV	WATER VALVE
P/L	PROPERTY LINE	WV	WELDED WIRE FABRIC
PSI	POUNDS PER SQUARE INCH	WV	EXIST. CATCH BASIN
PVI	POINT OF VERTICAL INTERSECTION	WV	DESCRIPTION
RCP	REINFORCED CONC. PIPE	WV	TYPICAL
RET.	RETAINING	WV	WITH
REIN.	REINFORCED	WV	WATERLINE
SHLD.	SHOULDER	WV	WATER VALVE
SMH	SEWER MANHOLE	WV	WELDED WIRE FABRIC
STA	STATION	WV	EXIST. CATCH BASIN



REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)				
GENERAL SITE DEVELOPMENT PLAN				
RECOMMENDED BY:				
CHIEF OF ENGINEERING DATE				
DRAWER				



1 EXISTING CONDITION
C-1 SCALE: 1" = 30'-0"



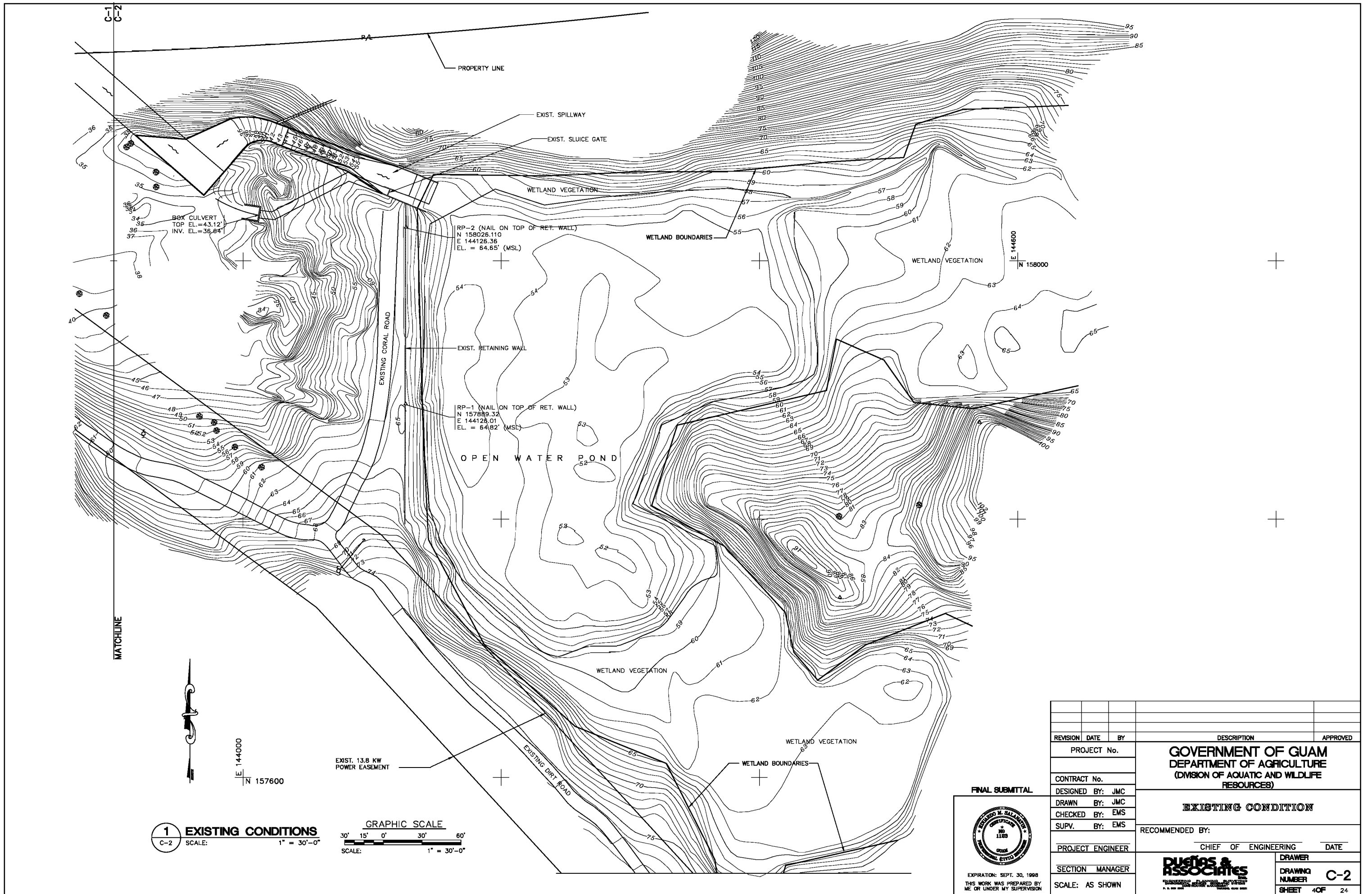
FINAL SUBMITTAL




EXPIRATION: SEPT. 30, 1998
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

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PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.			EXISTING CONDITION	
DESIGNED BY: JMC			RECOMMENDED BY:	
DRAWN BY: JMC			CHIEF OF ENGINEERING	
CHECKED BY: EMS			DATE	
SUPV. BY: EMS			DRAWER	
PROJECT ENGINEER			DRAWING NUMBER	
SECTION MANAGER			C-1	
SCALE: AS SHOWN			SHEET 30F 24	

Duenas & Associates
INCORPORATED
1000 N. NIMITZ HILL
GUAM, GUAM 96911

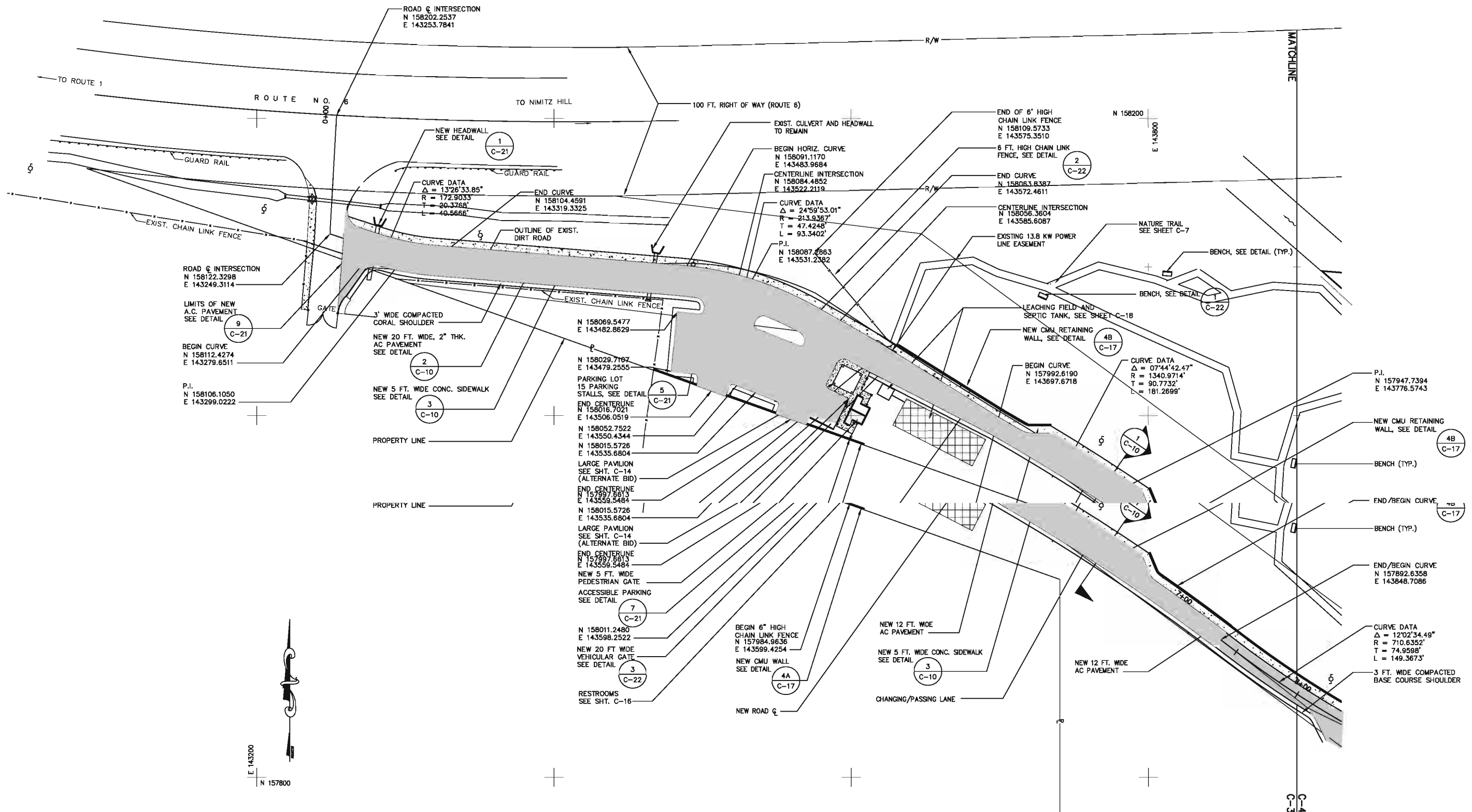


REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE REBOURCES)	
CONTRACT No.				
DESIGNED BY: JMC			EXISTING CONDITION	
DRAWN BY: JMC				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER			RECOMMENDED BY:	
SECTION MANAGER			CHIEF OF ENGINEERING	
SCALE: AS SHOWN			DATE	
<div><p>Dugas & Associates INCORPORATED REGISTERED PROFESSIONAL ENGINEERS P. O. BOX 9082 HONOLULU, HAWAII 96809</p></div>			DRAWER	
			DRAWING NUMBER C-2	
			SHEET 40F 24	

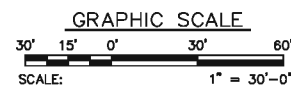
FINAL SUBMITTAL



EXPIRATION: SEPT. 30, 1998
THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION



1 SITE AND GEOMETRIC PLAN
C-3 SCALE 1" = 30'-0"



FINAL SUBMITTAL



REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: JMC				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
RECOMMENDED BY:				
CHIEF OF ENGINEERING DATE				
DRAWER				

GOVERNMENT OF GUAM
DEPARTMENT OF AGRICULTURE
(DIVISION OF AQUATIC AND WILDLIFE RESOURCES)

SITE AND GEOMETRIC PLAN

RECOMMENDED BY:

CHIEF OF ENGINEERING DATE

DRAWER




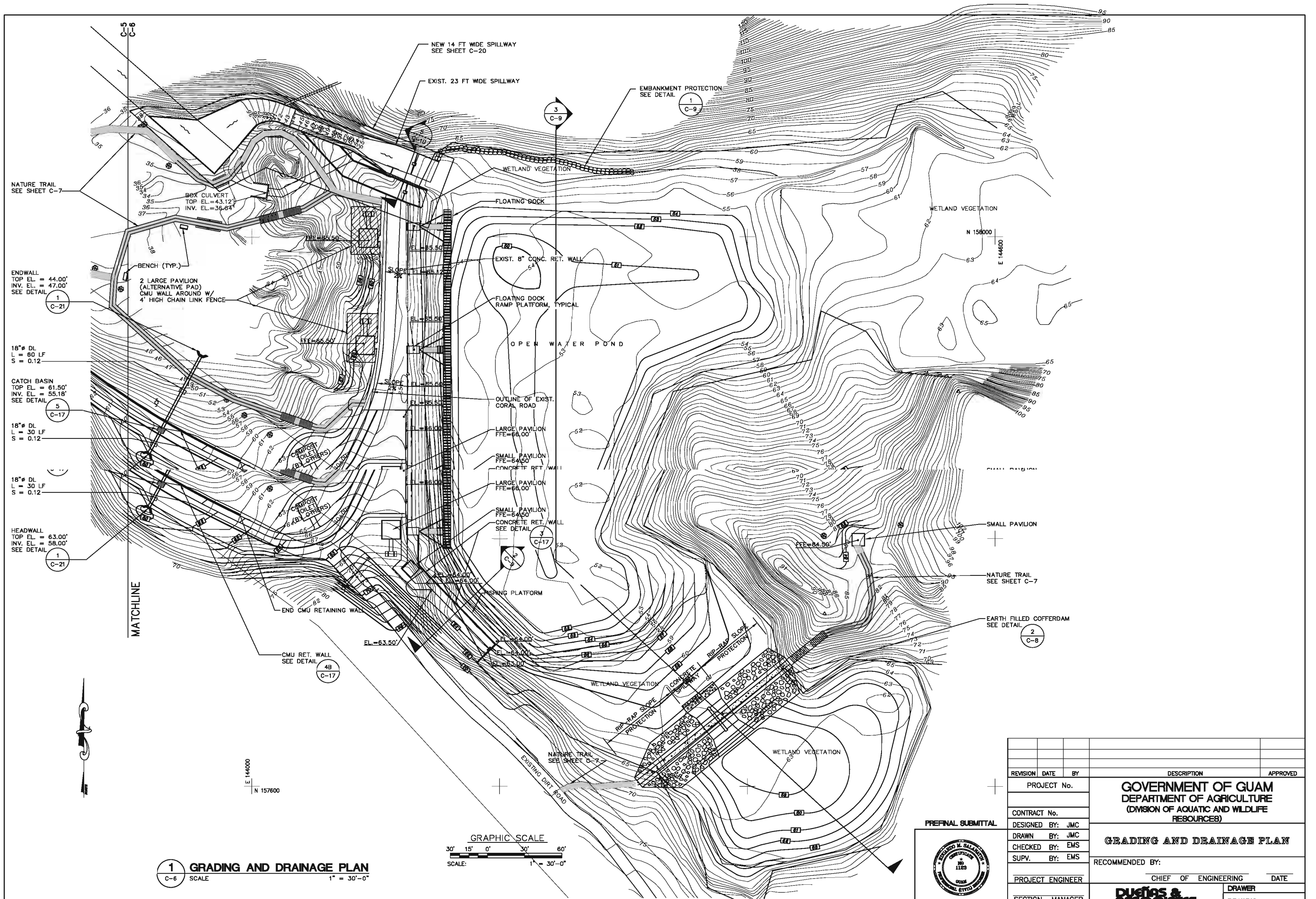
GRAPHIC SCALE

30' 15' 0' 30' 60'



SCALE: 1" = 30'-0"

REVISION	DATE	BY	DESCRIPTION		APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)		
CONTRACT No.					
DESIGNED BY: JMC			GRADING, DRAINAGE AND UTILITY PLAN		
DRAWN BY: JMC					
CHECKED BY: EMS					
SUPV. BY: EMS					
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			CHIEF OF ENGINEERING		DATE
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					DRAWN



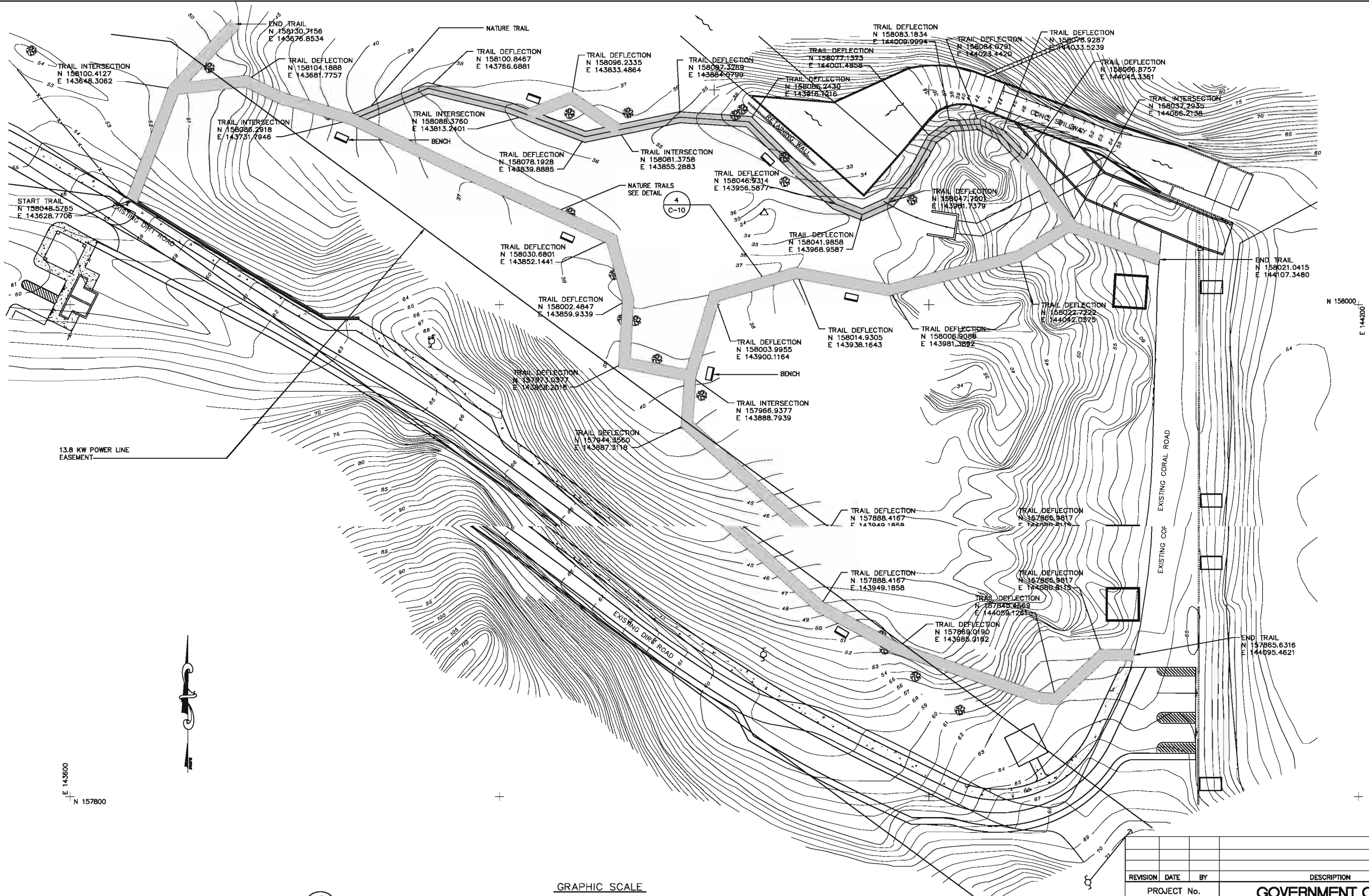
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SECTION MANAGER				
RECOMMENDED BY:				
CHIEF OF ENGINEERING				
DATE				
DRAWER				

GOVERNMENT OF GUAM
DEPARTMENT OF AGRICULTURE
(DIVISION OF AQUATIC AND WILDLIFE
RESOURCES)

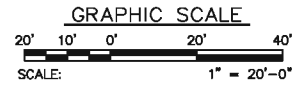
GRADING AND DRAINAGE PLAN

PRELIMINARY SUBMITTAL





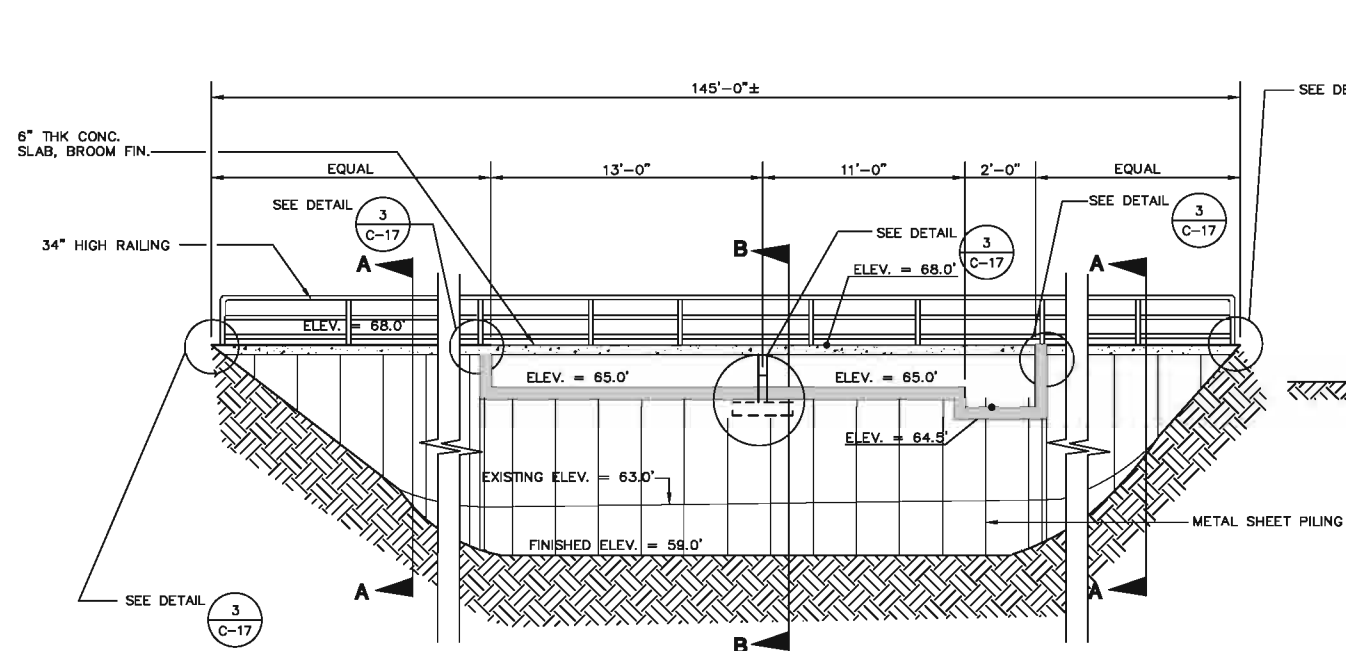
1 NATURE TRAIL PLAN
C-7 SCALE 1" = 20'-0"



100% SUBMITTAL



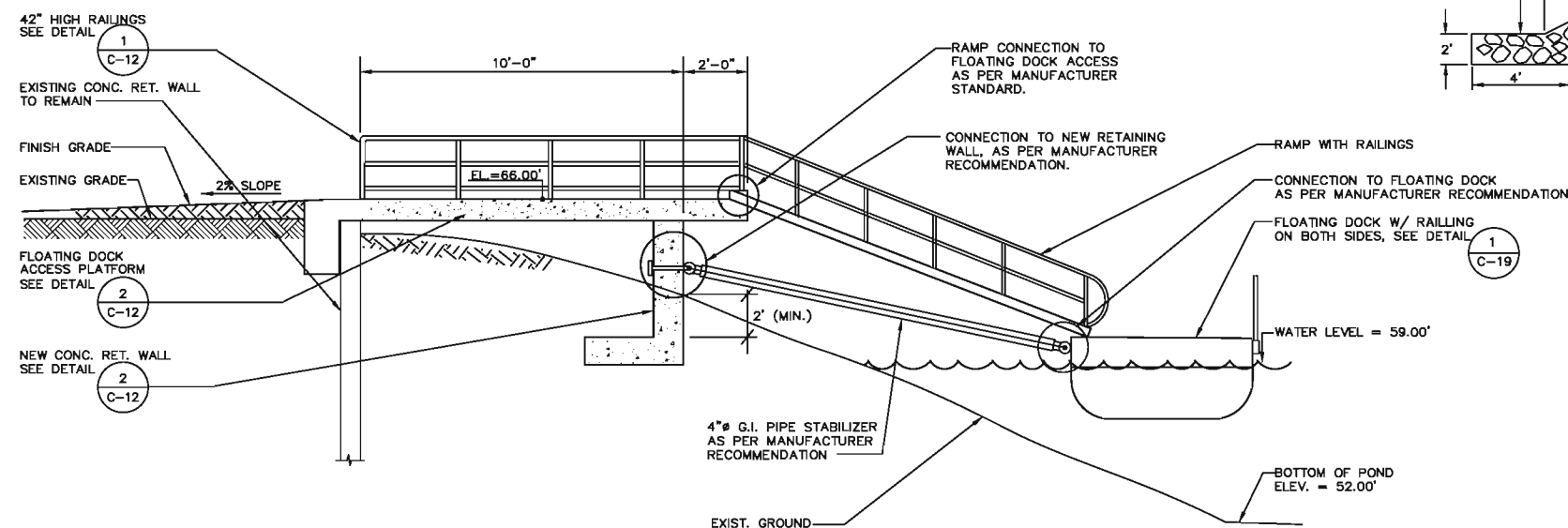
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.				
DESIGNED BY: JMC			NATURE TRAIL PLAN	
DRAWN BY: JMC				
CHECKED BY: EMS			RECOMMENDED BY:	
SUPV. BY: EMS				
PROJECT ENGINEER			CHIEF OF ENGINEERING	DATE
SECTION MANAGER			DUELOS & ASSOCIATES	DRAWER



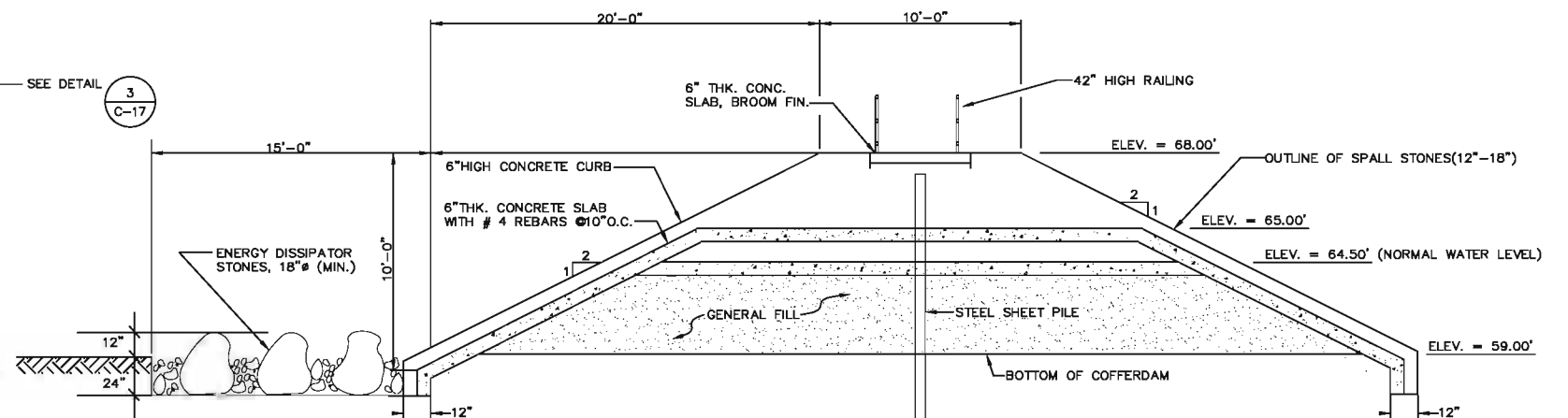
2A LONGITUDINAL SECTION
C-B NOT TO SCALE

2 EARTH FILLED COFFERDAM
C-B NOT TO SCALE

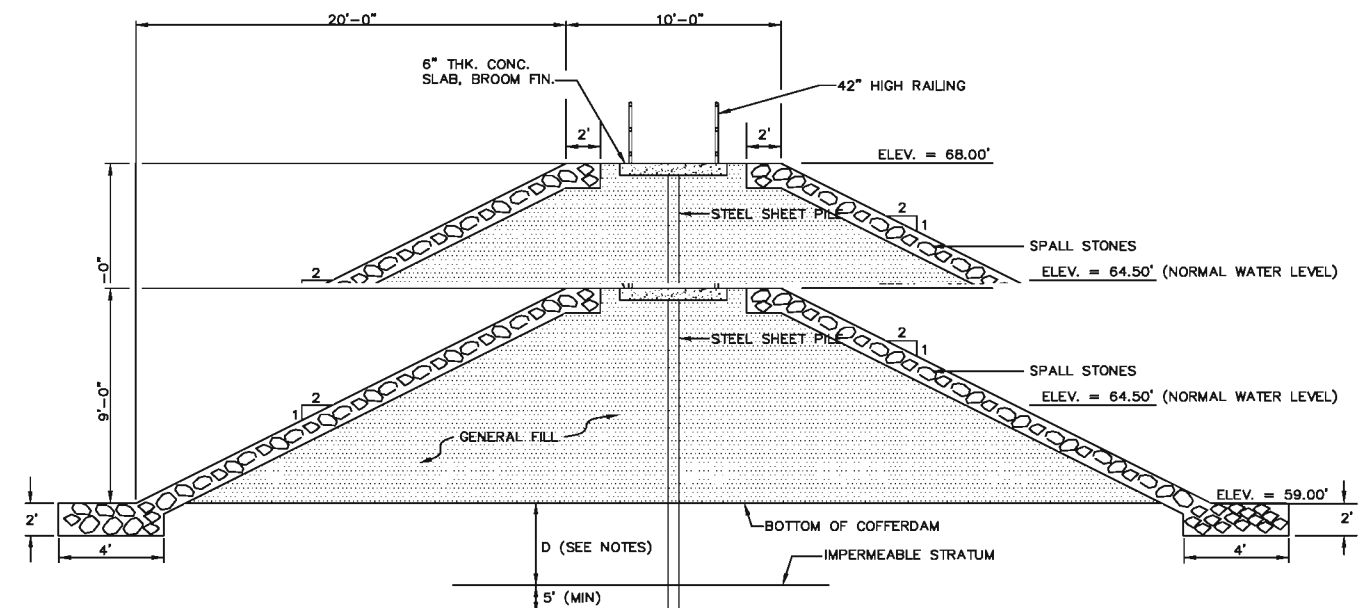
2 EARTH FILLED COFFERDAM
C-B NOT TO SCALE



1 FLOATING DOCK ACCESS (SECTION)
C-B NOT TO SCALE



2C SECTION 'B-B'
C-B NOT TO SCALE



2B SECTION 'A-A'
C-B NOT TO SCALE

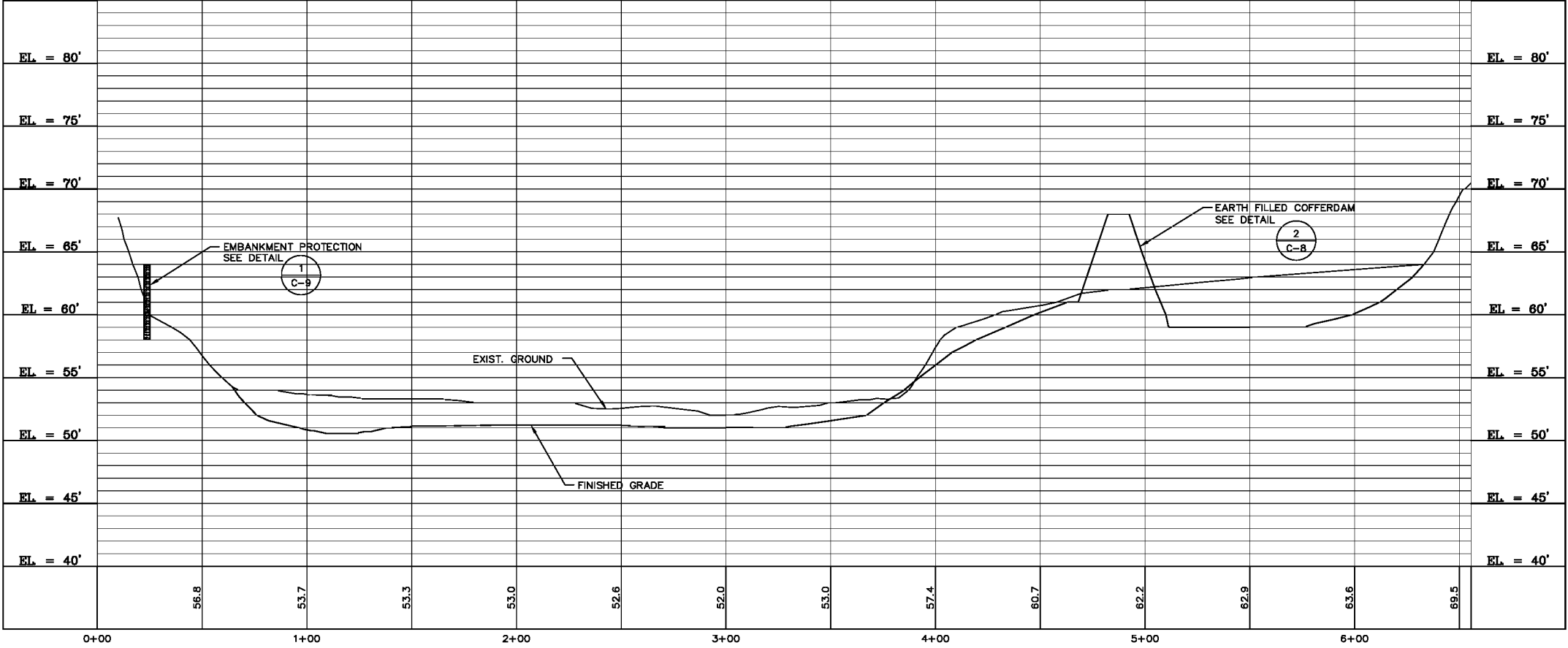
NOTES:

- 1 THE CONTRACTOR SHALL PERFORM SOIL SUBSURFACE INVESTIGATIONS TO DETERMINE DEPTH OF IMPERMEABLE STRATUM.
- 2 THE INVESTIGATION SHALL BE MADE BY A LICENSED SOILS/FOUNDATION ENGINEER IN GUAM.

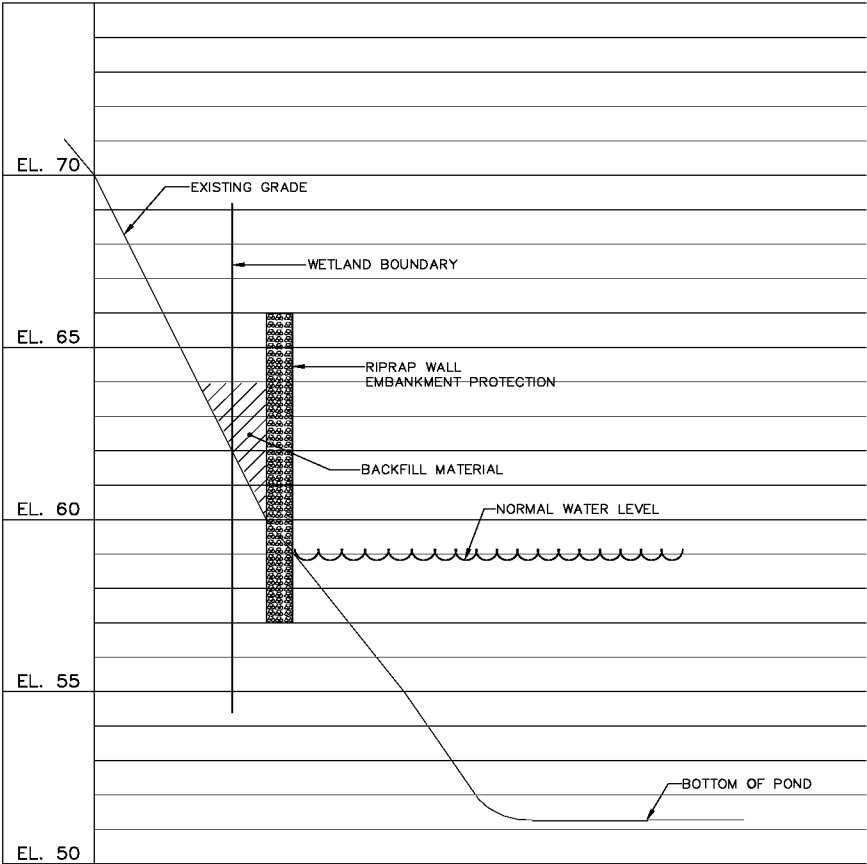
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: JMC				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)				
MISCELLANEOUS DETAILS				
RECOMMENDED BY:				
CHIEF OF ENGINEERING DATE				
DRAWER				

PRELIMINARY SUBMITTAL

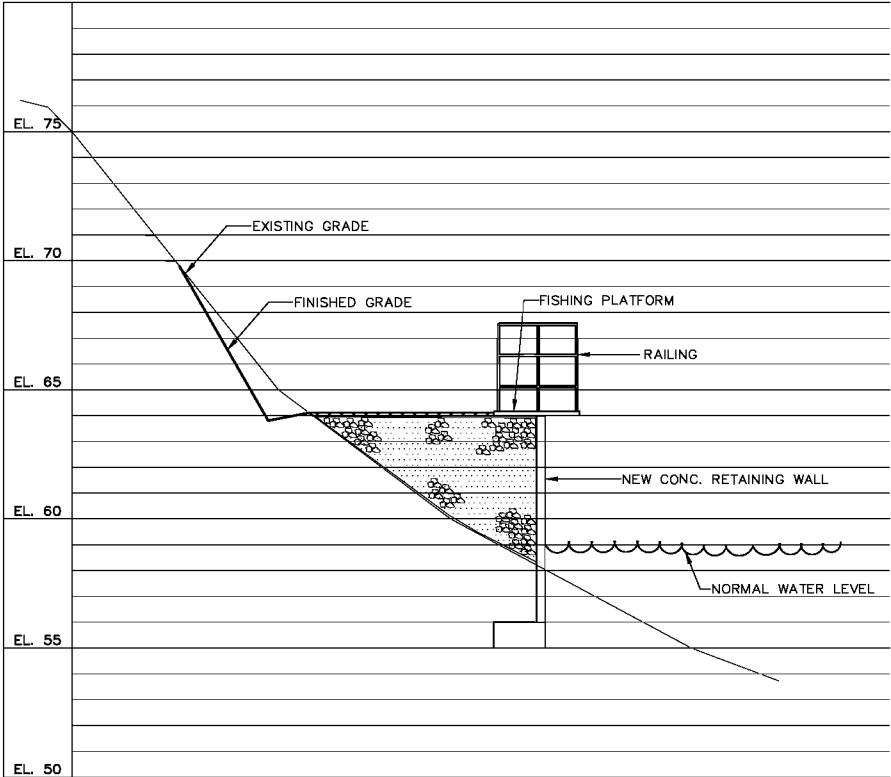




3 CROSS SECTION
C-9 SCALE: HOR. 1" = 30'-0"
VERT. 1" = 5'-0"



1 SECTION @ EMBANKMENT PROTECTION
C-9 SCALE: HOR. 1" = 10'-0"
VERT. 1" = 3'-0"



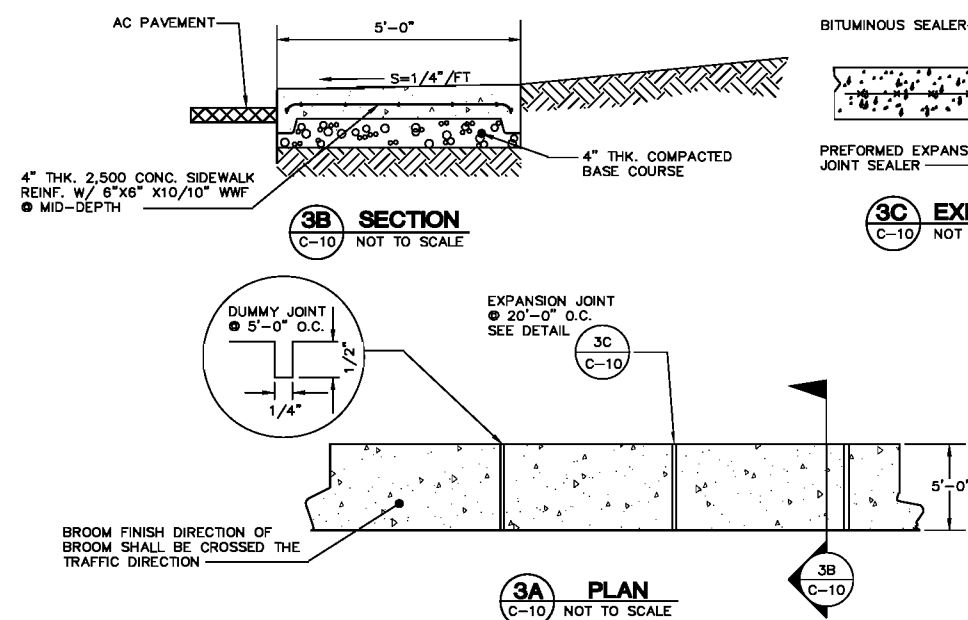
2 FISHING ACCESS (SECTION)
C-9 SCALE: HOR. 1" = 10'-0"
VERT. 1" = 5'-0"

100% SUBMITTAL

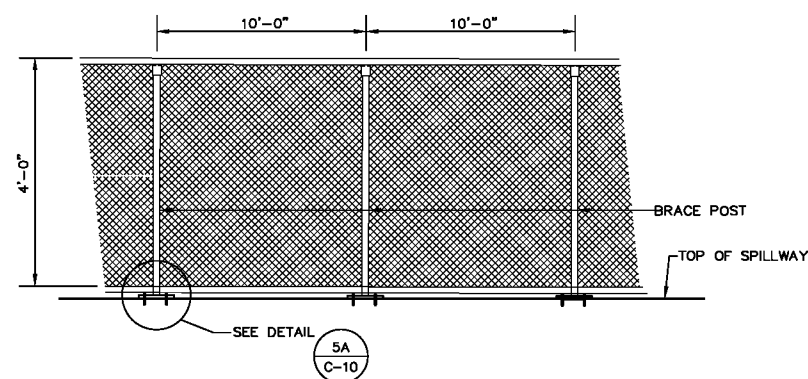
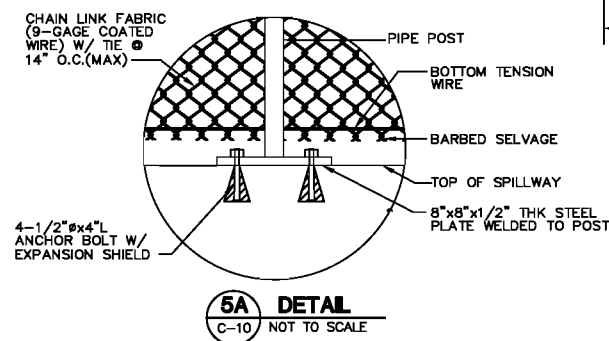
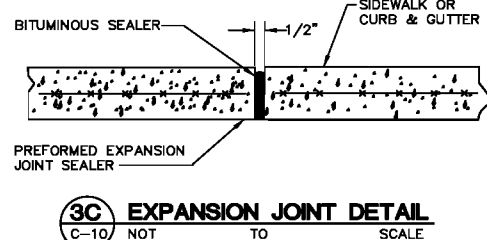
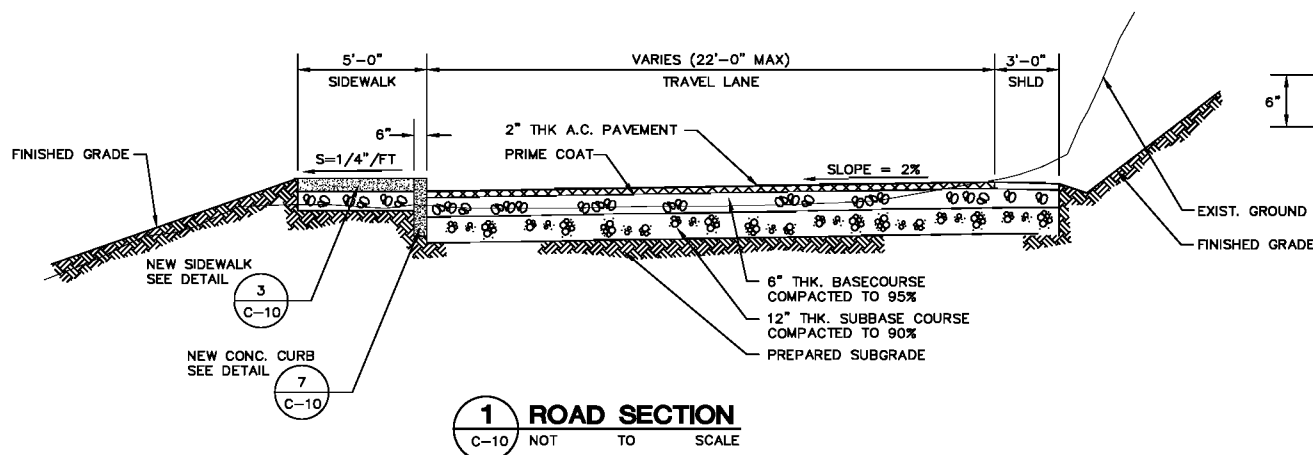
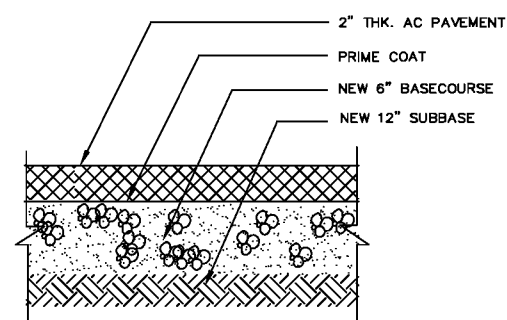


EXPIRATION (SEPT. 30, 1998)
THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

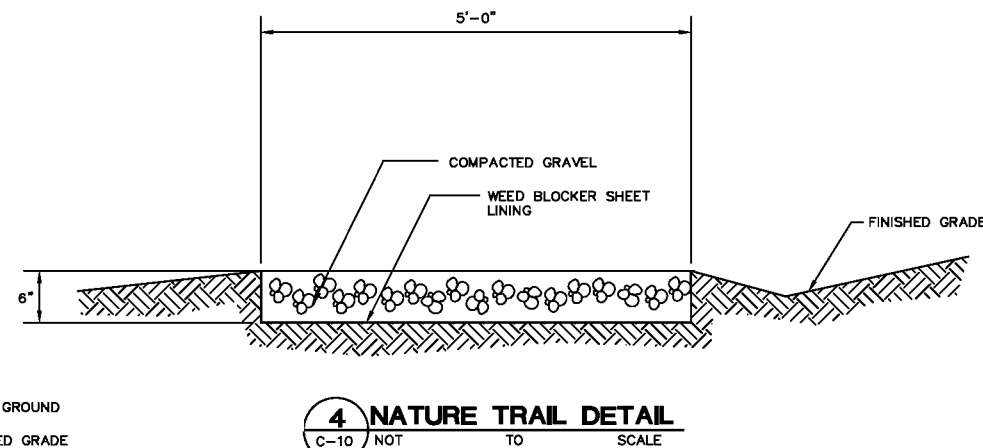
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.			CROSS SECTIONS	
DESIGNED BY: JMC			RECOMMENDED BY:	
DRAWN BY: JMC			CHIEF OF ENGINEERING	
CHECKED BY: EMS			DATE	
SUPV. BY: EMS			Duenas & Associates	
PROJECT ENGINEER			DRAWER	
SECTION MANAGER			DRAWING NUMBER C-9	
SCALE: NONE			SHEET OF	



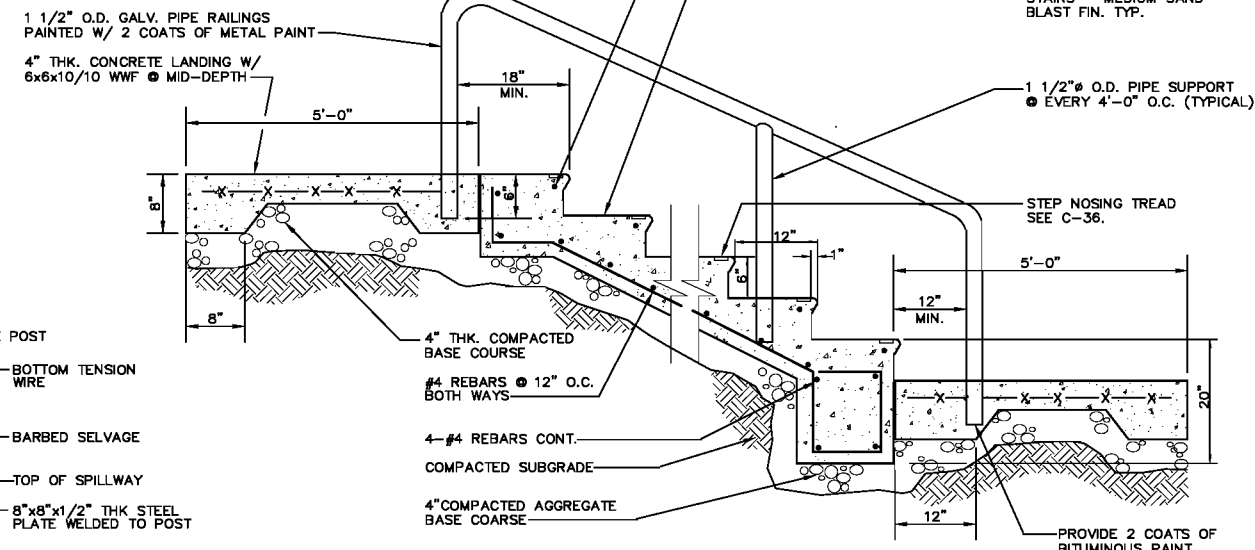
3 CONCRETE SIDEWALK DETAIL
C-10 NOT TO SCALE



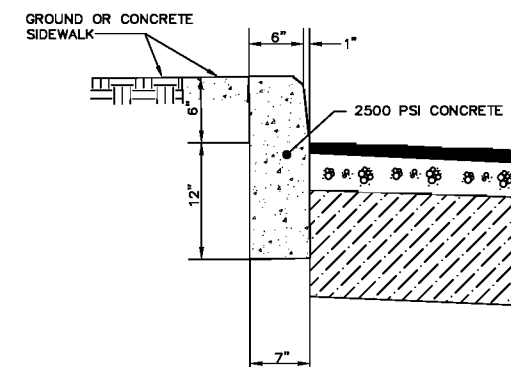
5 4 FT HIGH CHAIN LINK FENCE
C-10 NOT TO SCALE



4 NATURE TRAIL DETAIL
C-10 NOT TO SCALE



7 TYPICAL CONCRETE STAIR DETAIL
C-10 NOT TO SCALE



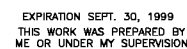
6 CONCRETE CURB
C-10 NOT TO SCALE

FINAL SUBMITTAL

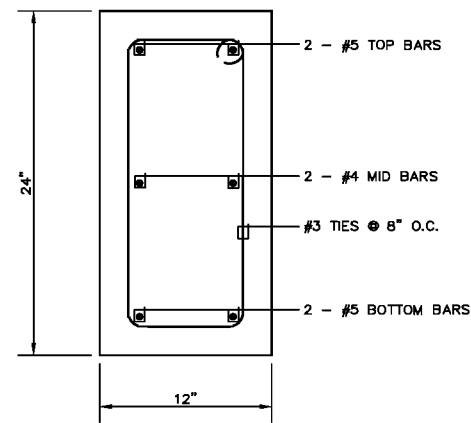


EXPIRATION (SEPT. 30, 1998)
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

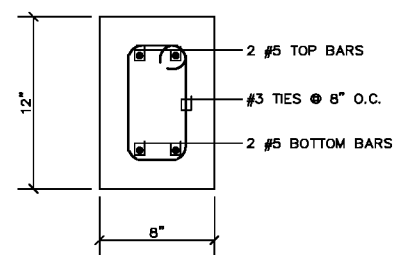
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.				
DESIGNED BY: RDD			MISC. DETAILS	
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS				
			RECOMMENDED BY:	
PROJECT ENGINEER			CHIEF OF ENGINEERING	
SECTION MANAGER			DATE	
SCALE: NONE			<div><div>Duenas & Associates</div><div><small>ENGINEERING PLANNING ARCHITECTURE "EXPERIENCE MAKES THE DIFFERENCE" 2000 HICKORY BLVD., SUITE 100 F. O. BOX 4000 AGANA, GUAM 96911</small></div></div>	
			DRAWER	
			DRAWING NUMBER	C-10
			SHEET	1 OF 2



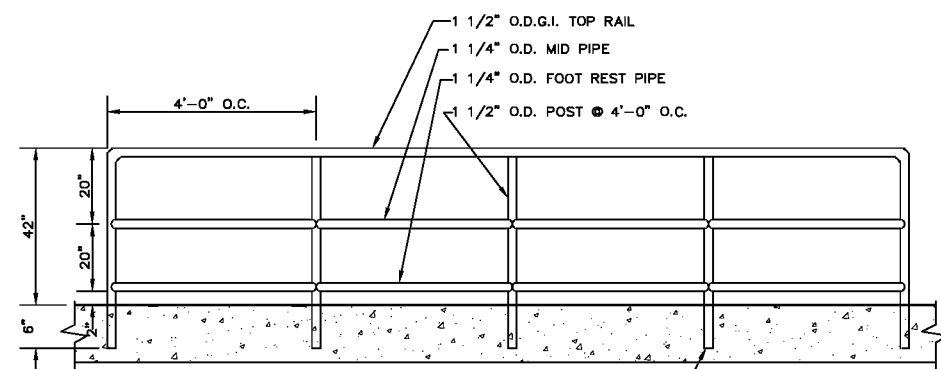
REVISION	DATE	BY	DESCRIPTION		APPROVED	
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)			
CONTRACT No.						
DESIGNED BY: RDD						
DRAWN BY: RDD			FISHING PLATFORM DETAIL			
CHECKED BY: EMS						
SUPV. BY: EMS						
PROJECT ENGINEER			RECOMMENDED BY:			
			CHIEF OF ENGINEERING		DATE	
SECTION MANAGER			Duffus & Associates <small>ENGINEERING PLANNING SURVEYING ARCHITECTURE INTERIOR DESIGN LANDSCAPE ARCHITECTURE SPECIAL ANALYSIS GROUP</small>		DRAWER	
SCALE: NONE					DRAWING NUMBER	C-11
					SHEET	1 OF 24



2D RB-4
C-12 NOT TO SCALE



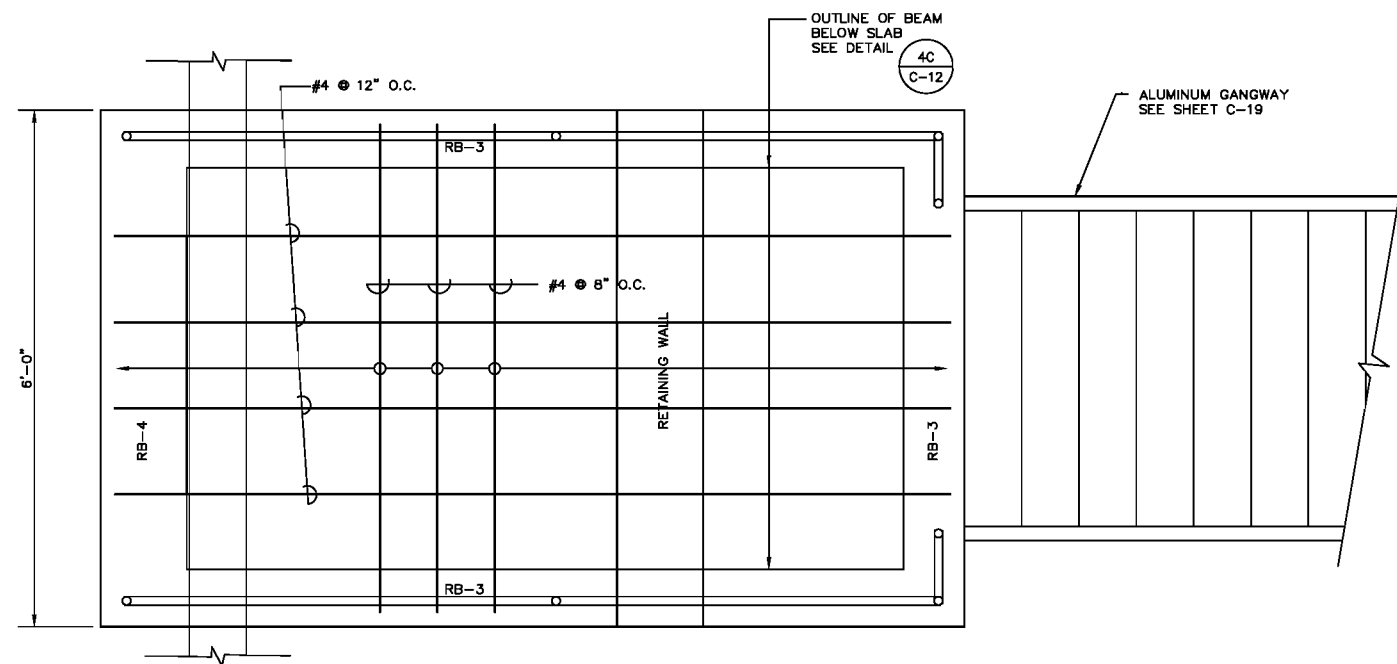
2C RB-3
C-12 NOT TO SCALE



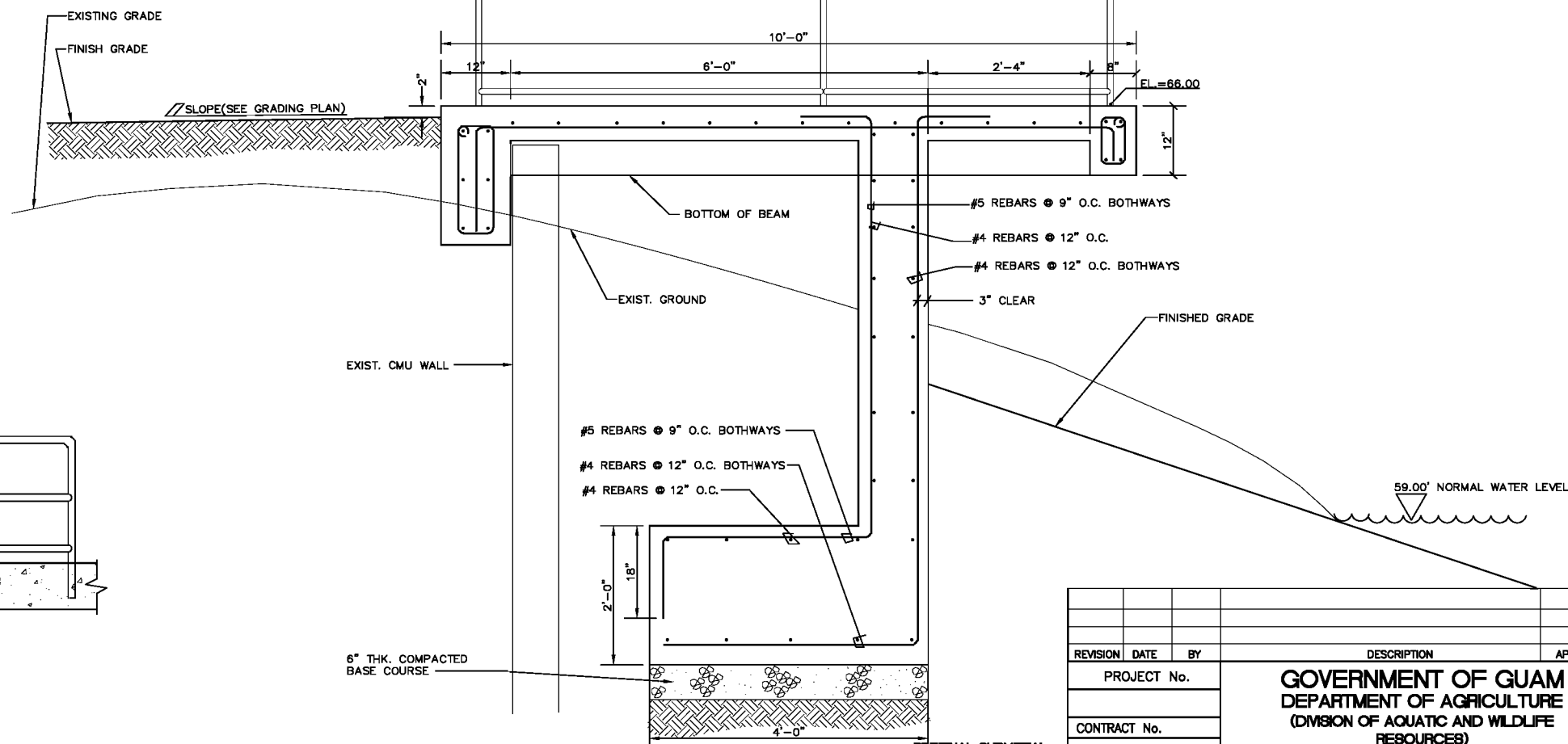
NOTE:
1. ALL PIPE JOINTS SHALL BE FULLY WELDED
2. ENDS SHALL BE ROUNDED

PROVIDE 2 COATS OF
BITUMINOUS COATING
(TYPICAL TO ALL PIPES
EMBEDDED IN CONCRETE)

1 42" HIGH RAILING DETAIL
C-12 NOT TO SCALE



2B PLAN
C-12 SCALE: 1"=1'-0"



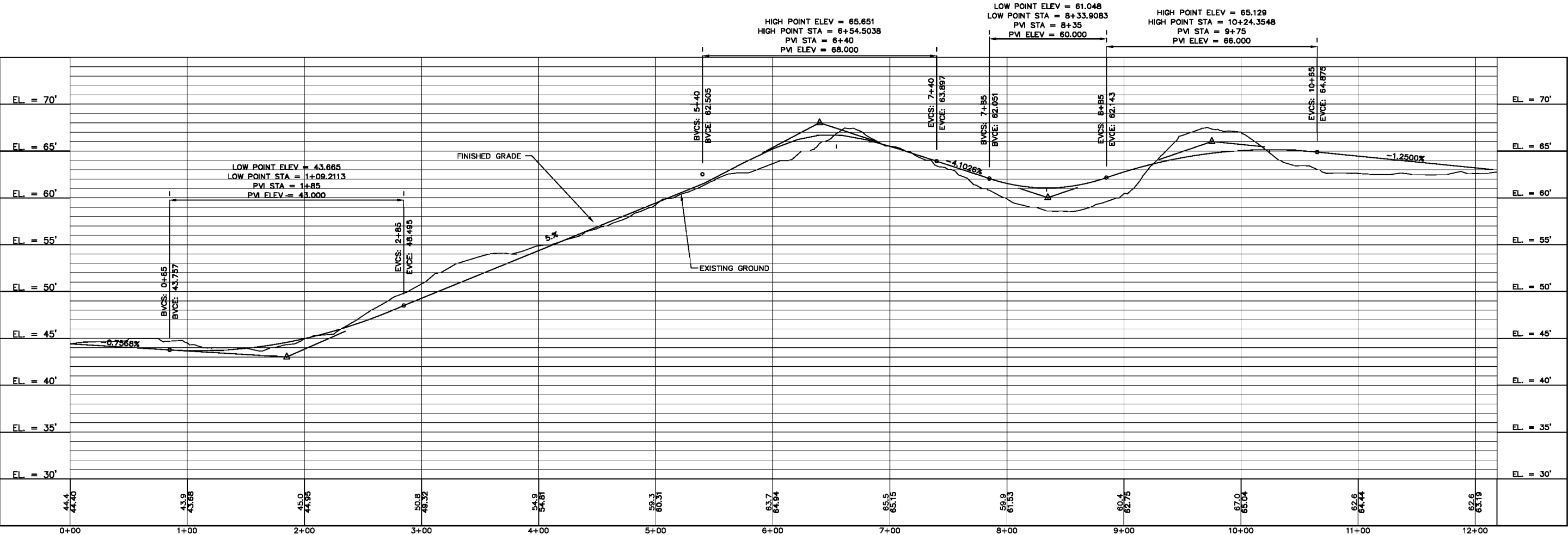
2A ELEVATION
C-12 SCALE: 1"=1'-0"

2 FLOATING DOCK ACCESS DETAIL
C-12 SCALE: 1"=1'-0"

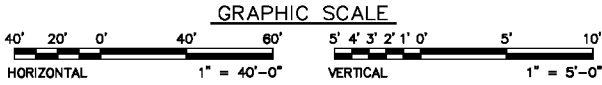


EXPIRATION SEPT. 30, 1999
THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

REVISION	DATE	BY	DESCRIPTION	APPROVED	
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)		
CONTRACT No.			FLOATING DOCK ACCESS DETAIL		
DESIGNED BY: RDD					
DRAWN BY: RDD			RECOMMENDED BY:		
CHECKED BY: EMS					
SUPV. BY: EMS			CHIEF OF ENGINEERING		
PROJECT ENGINEER			DATE		
SECTION MANAGER			DUEÑAS & ASSOCIATES		
SCALE: NONE			DRAWER		
			DRAWING NUMBER C-12		
			SHEET 1 OF 24		



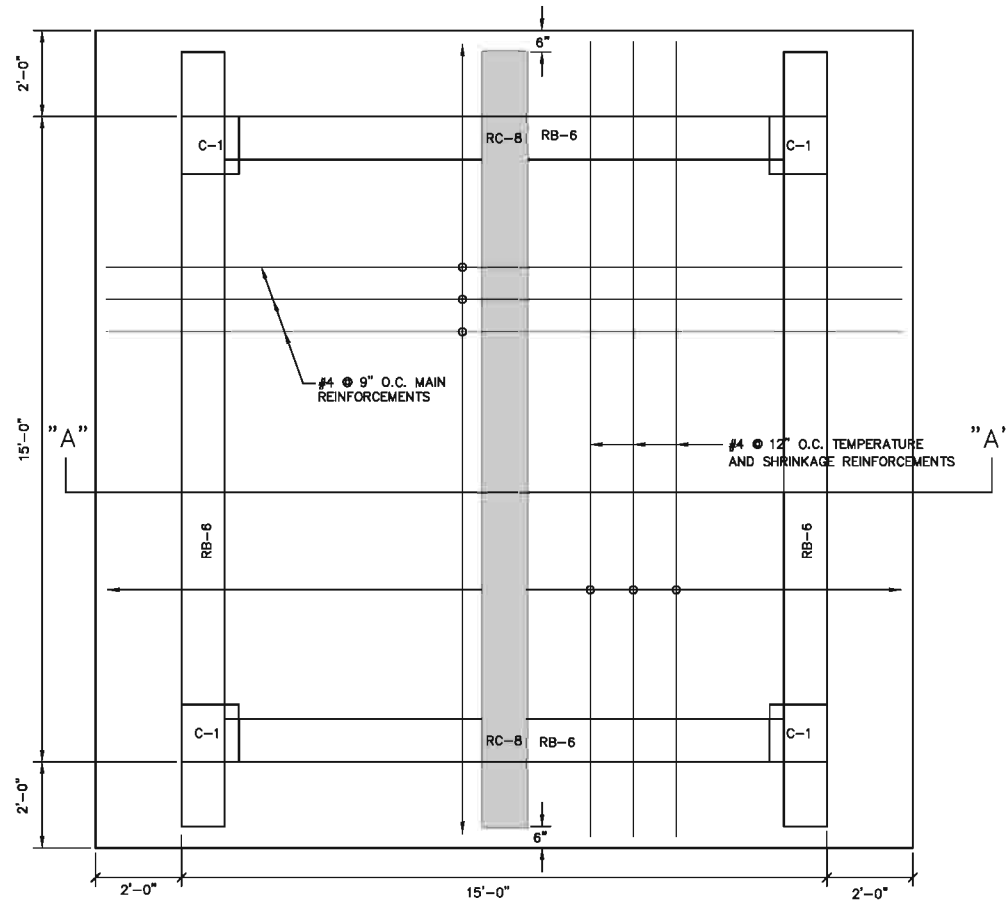
1 ROAD CENTERLINE PROFILE (STA 0+00 TO STA 12+18.50)
C-13 SCALE: HORIZ. 1" = 40'-0" VERT. 1" = 5'-0"



PRELIMINARY SUBMITTAL

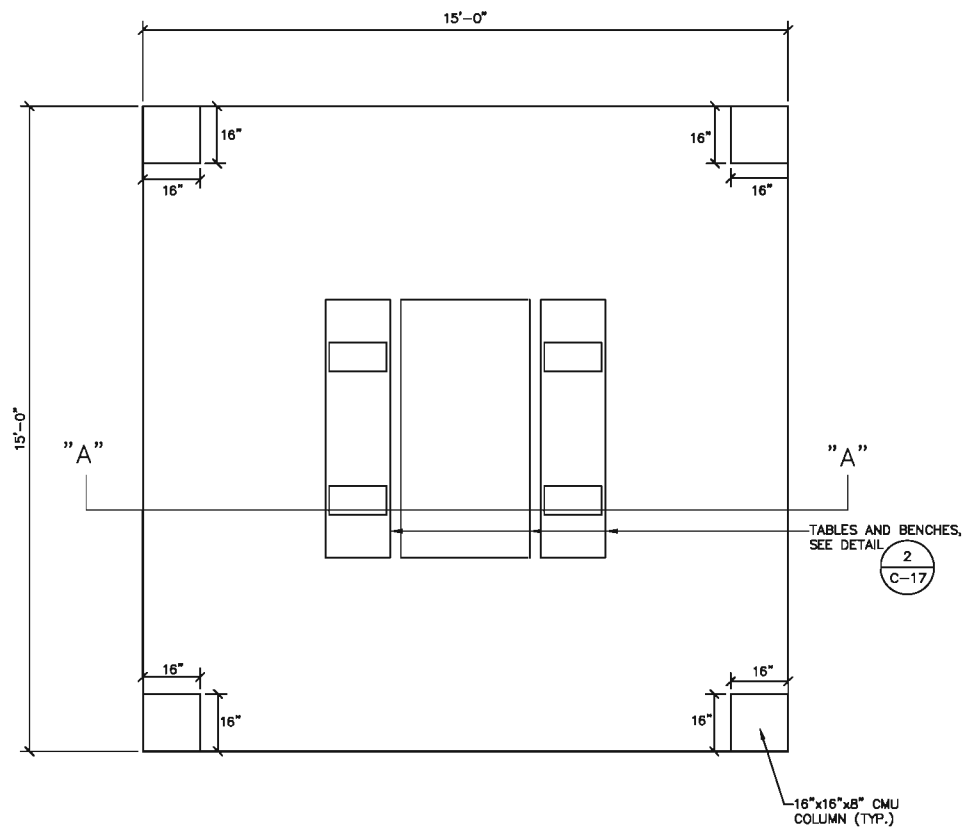
EXPIRATION: SEPT. 30, 1999
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.				
DESIGNED BY: RDD				
DRAWN BY: RDD				
CHECKED BY: EMS			ROAD CL PROFILE	
SUPV. BY: EMS				
PROJECT ENGINEER			RECOMMENDED BY:	
SECTION MANAGER			CHIEF OF ENGINEERING	
SCALE: NONE			DATE	
			Duenas & Associates	
			DRAWER	
			DRAWING NUMBER	
			C-13	
			SHEET 1 OF 24	

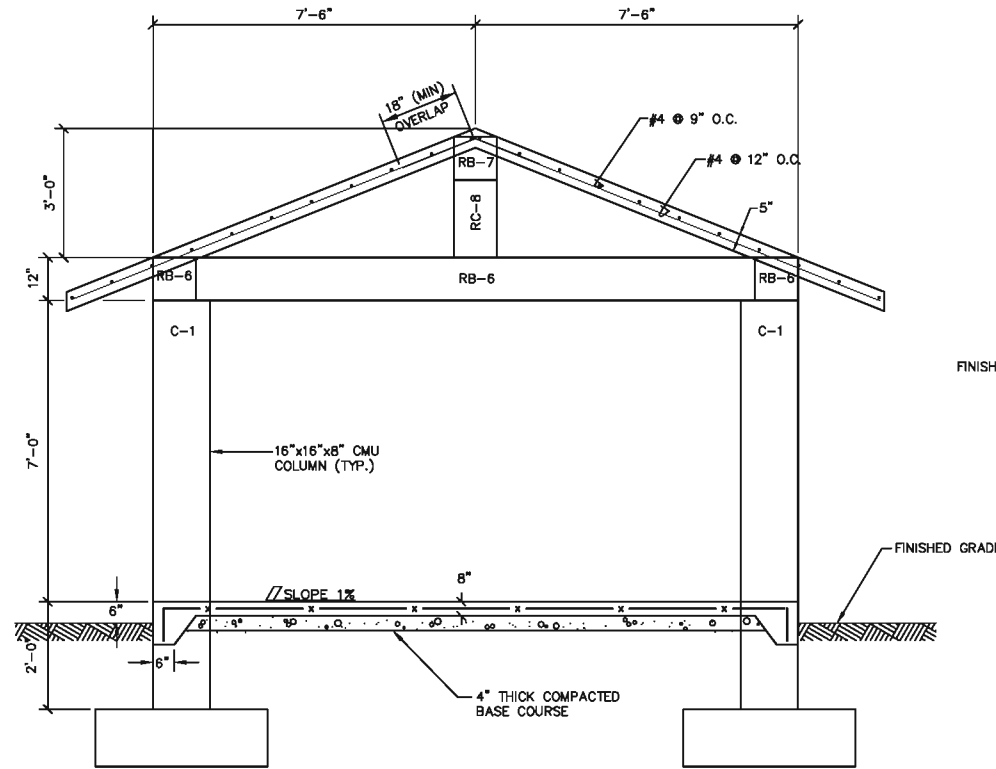


2 ROOF FRAMING PLAN (15'x15') PAVILION
MD-14 SCALE: 1\"/>

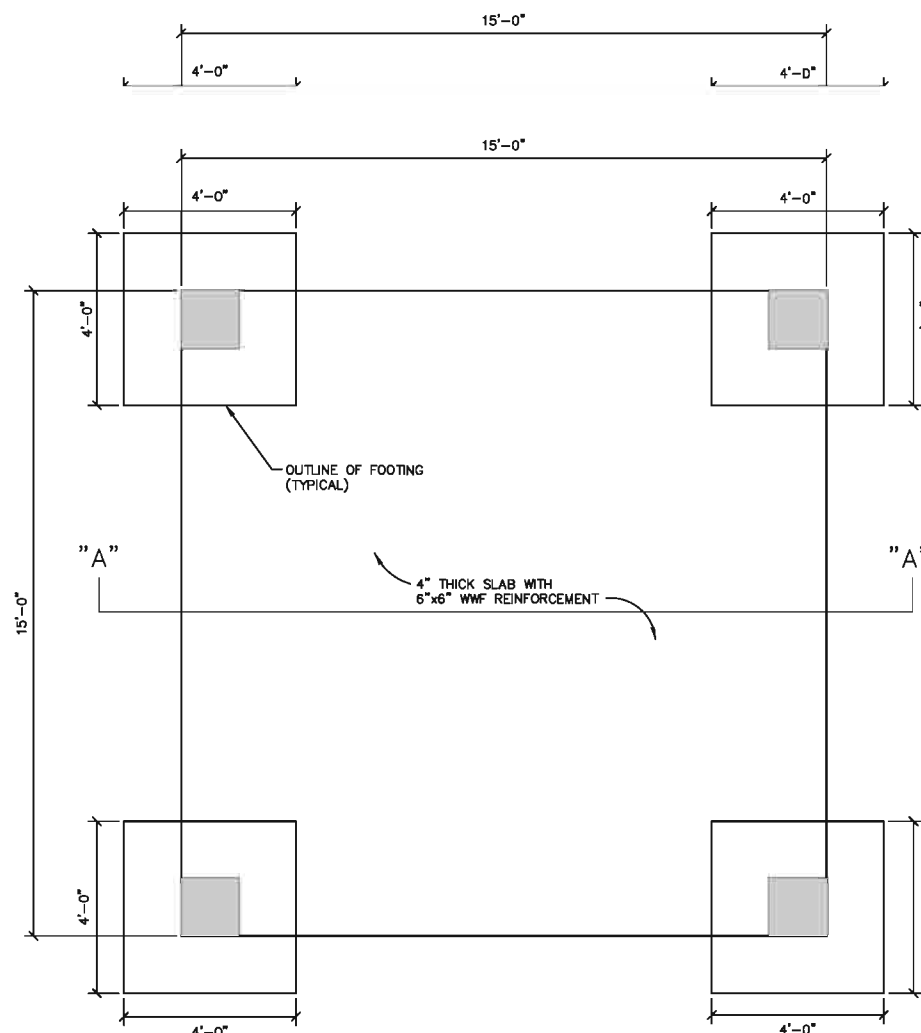
2 ROOF FRAMING PLAN (15'x15') PAVILION
MD-14 SCALE: 1\"/>



1 FLOOR PLAN (15'x15') PAVILION
MD-14 SCALE: 1\"/>

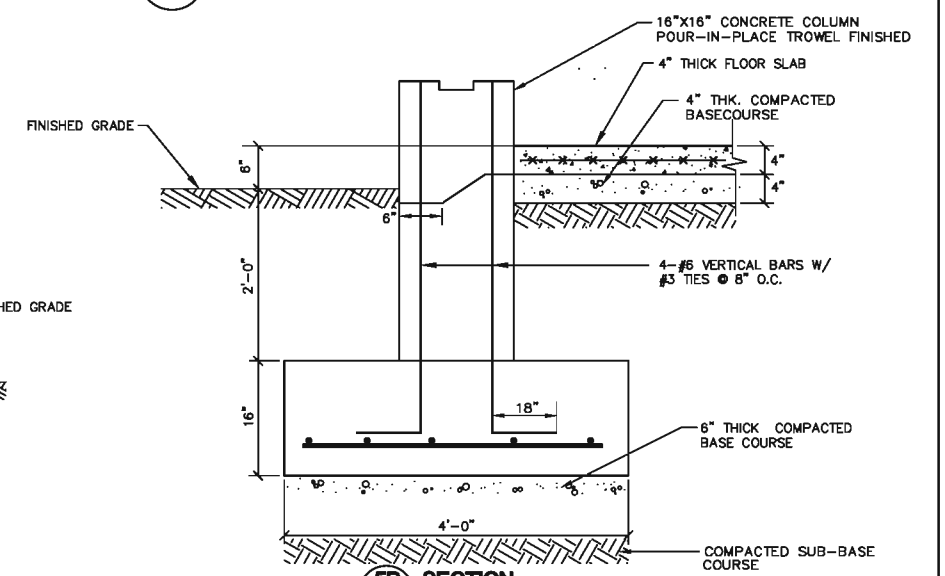


4 SECTION "A-A"
C-14 SCALE: 1\"/>

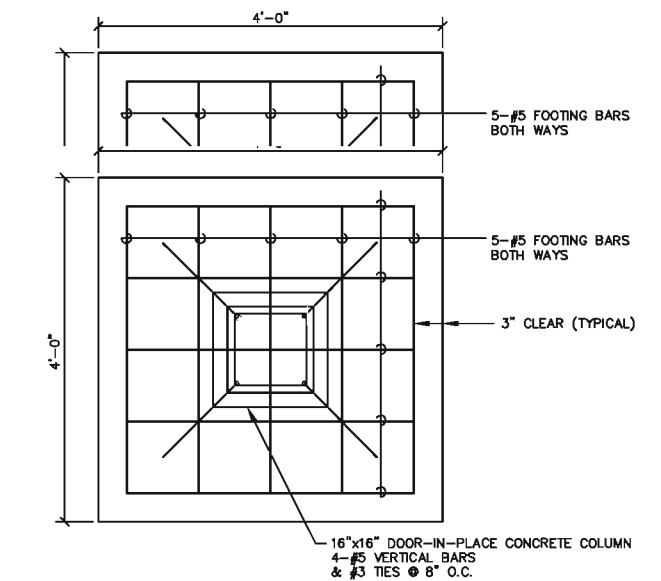


3 FOUNDATION PLAN
MD-14 SCALE: 1\"/>

6 TYPICAL SECTION (RB-6, RB-7 & RC-8)
C-14 SCALE: 1\"/>



5B SECTION
C-14 SCALE: 1\"/>



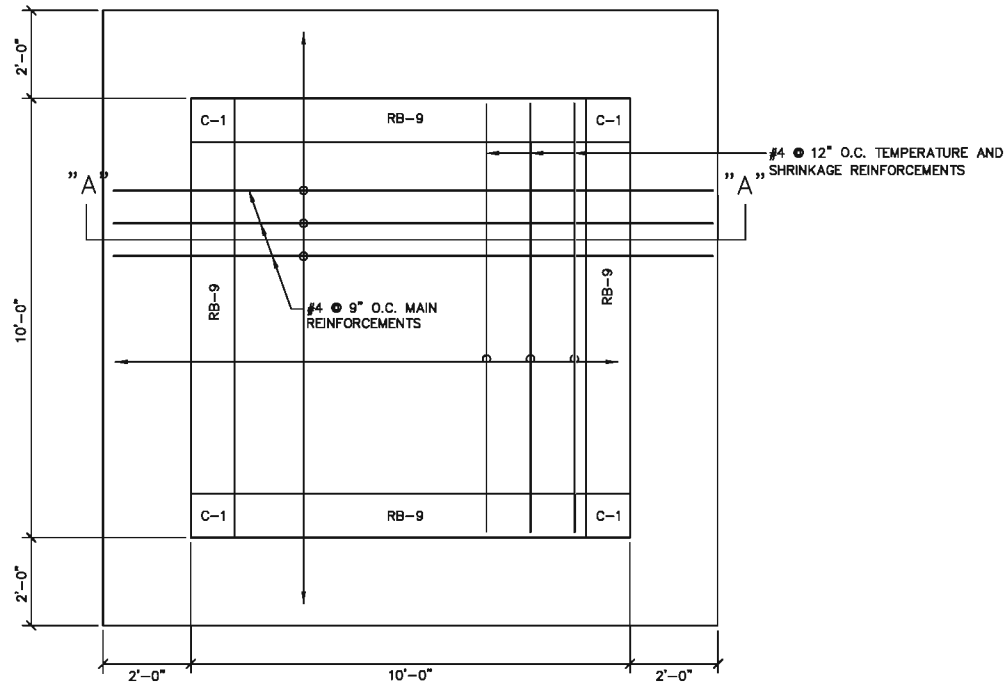
5A PLAN
C-14 NOT TO SCALE

5 COLUMN / FOOTING DETAIL
C-14 SCALE: 1\"/>

REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: MT				
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)				
15' x 15' PAVILION				
RECOMMENDED BY:				
CHIEF OF ENGINEERING DATE				
DRAWER				

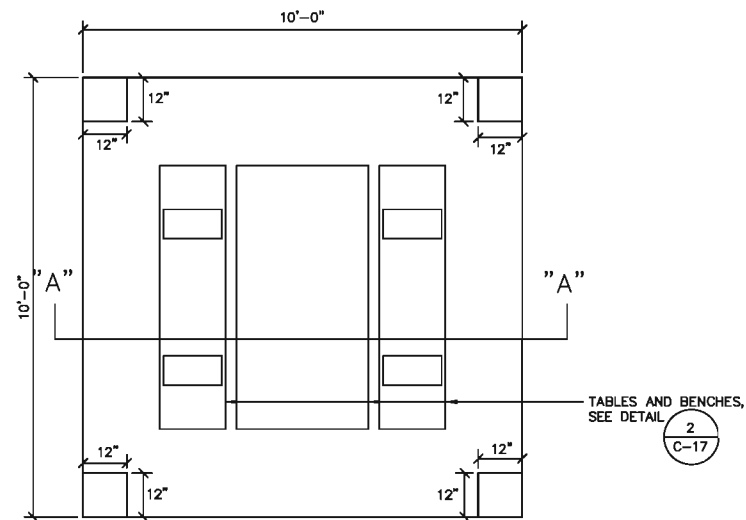
FINAL SUBMITTAL



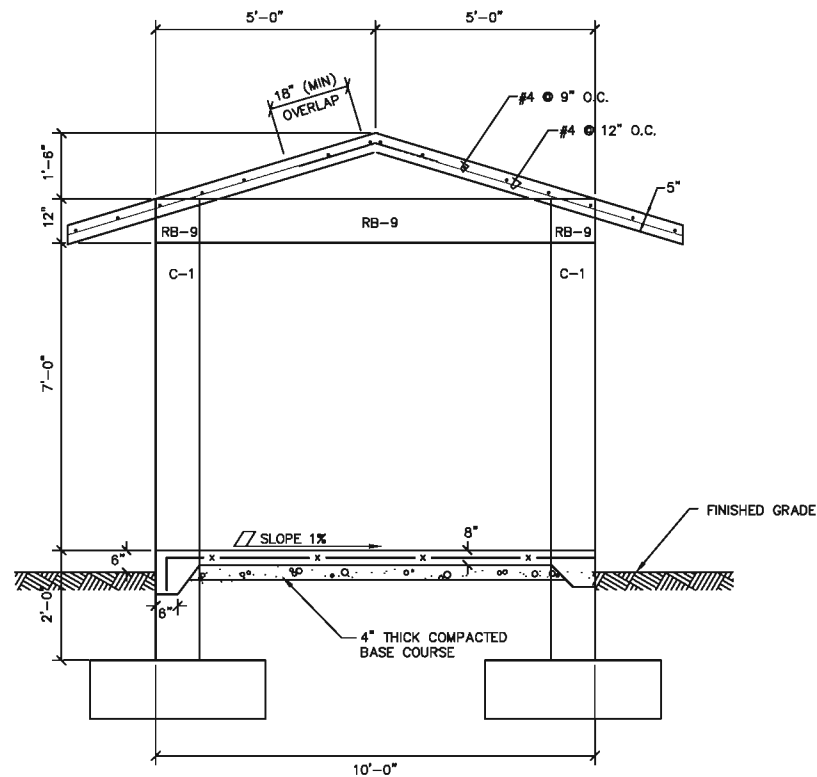


2 ROOF FRAMING PLAN (10'x10') PAVILION
C-15 SCALE: 1"=2'-0"

2 ROOF FRAMING PLAN (10'x10') PAVILION
C-15 SCALE: 1"=2'-0"

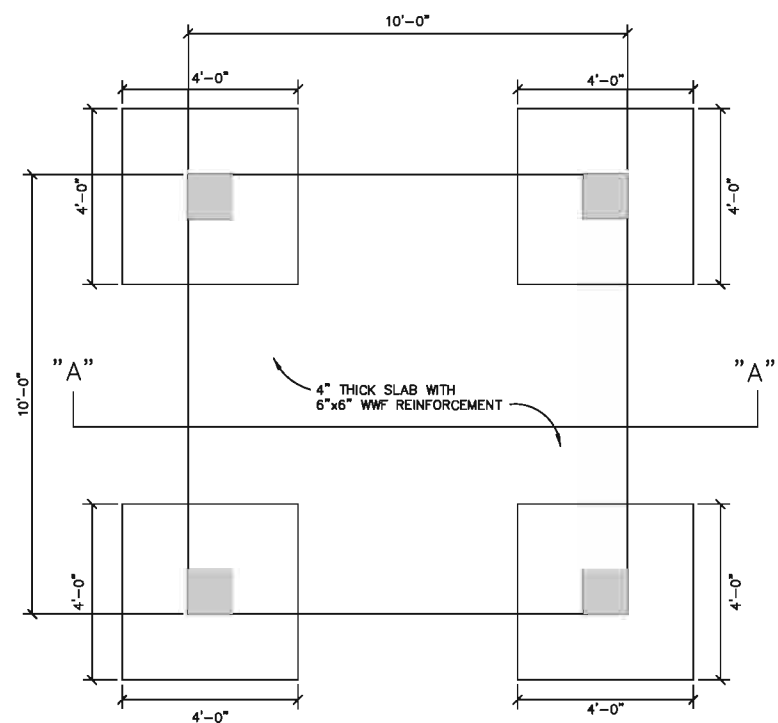


1 FLOOR PLAN (10'x10') PAVILION

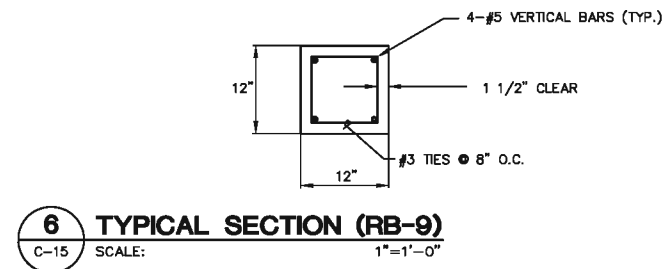


4 SECTION 'A-A'
C-15 SCALE: 1"=1'-0"

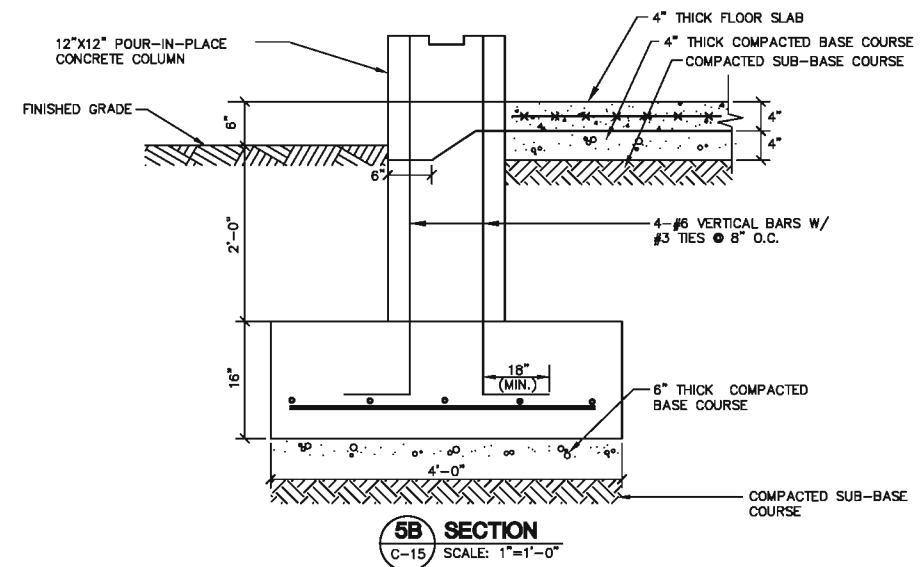
4 SECTION 'A-A'
C-15 SCALE: 1"=1'-0"



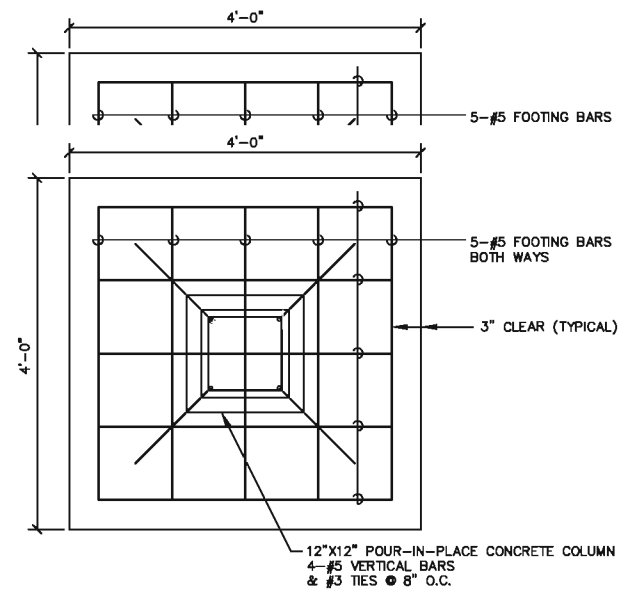
3 FOUNDATION PLAN



6 TYPICAL SECTION (RB-9)
C-15 SCALE: 1"=1'-0"



5B SECTION
C-15 SCALE: 1"=1'-0"



5A PLAN
C-15 NOT TO SCALE

5 COLUMN / FOOTING DETAIL
C-15 SCALE: 1"=1'-0"

100 % SUBMITTAL

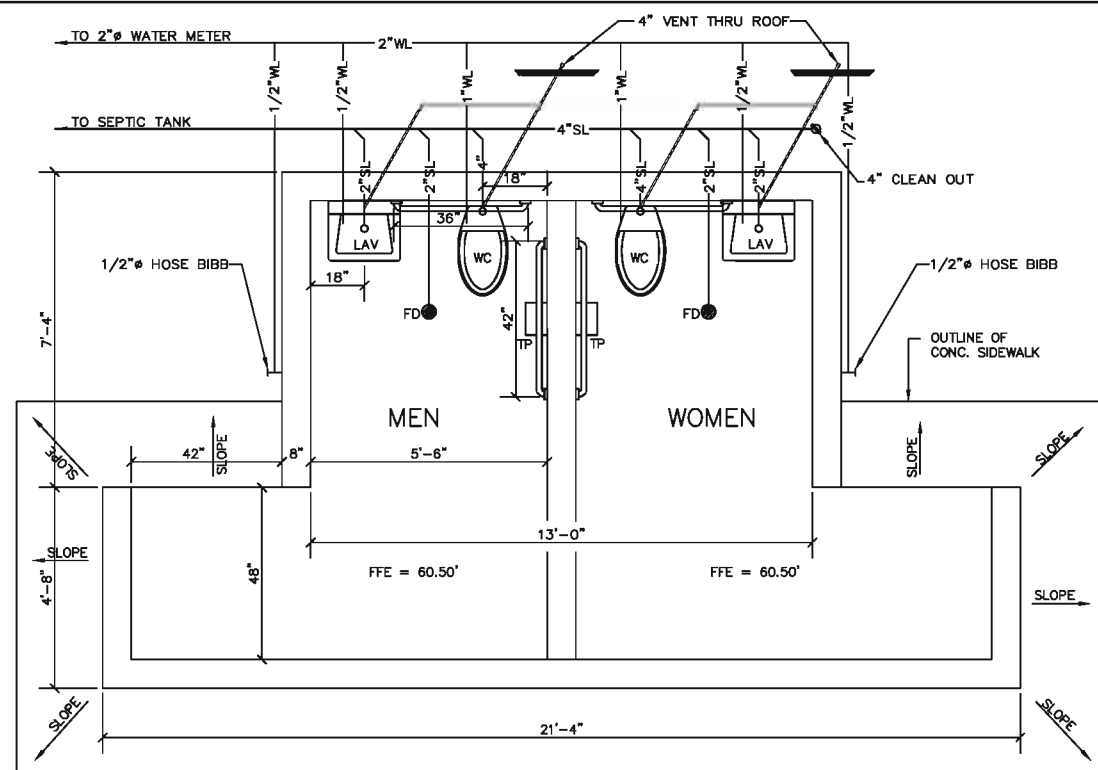


REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: ROD				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
CHIEF OF ENGINEERING				
DATE				

GOVERNMENT OF GUAM
DEPARTMENT OF AGRICULTURE
(DIVISION OF AQUATIC AND WILDLIFE RESOURCES)

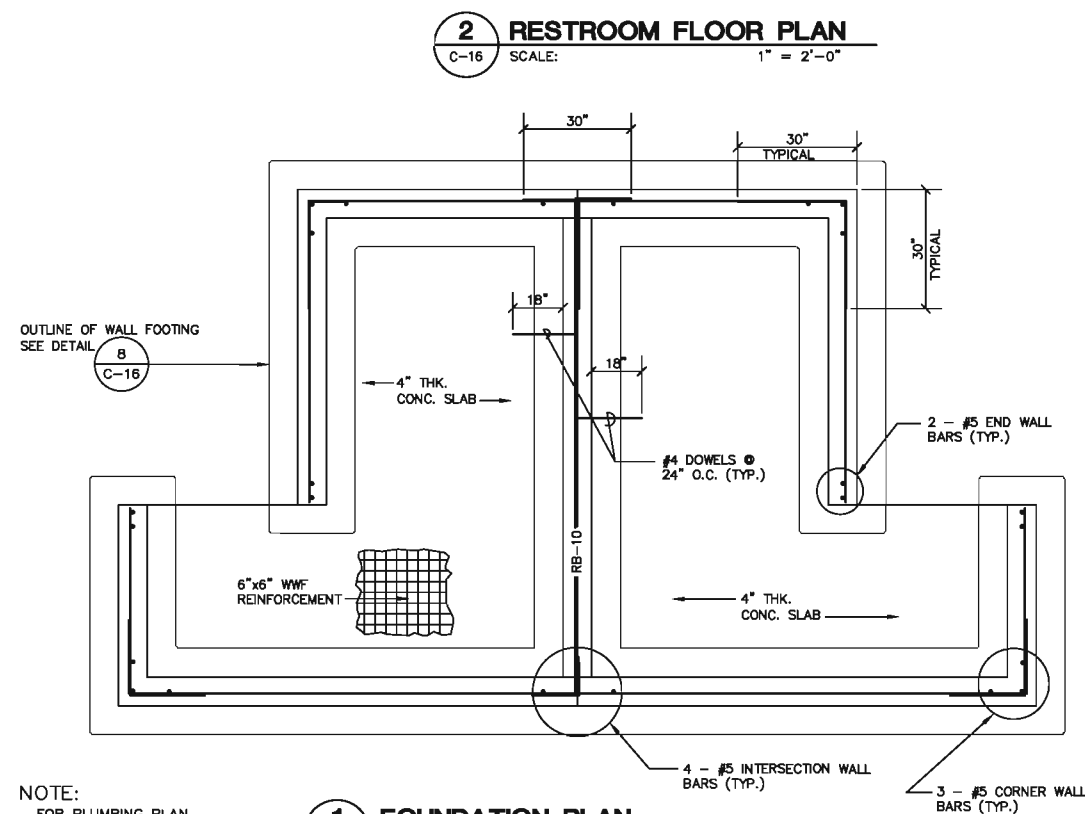
10' x 10' PAVILION

RECOMMENDED BY:

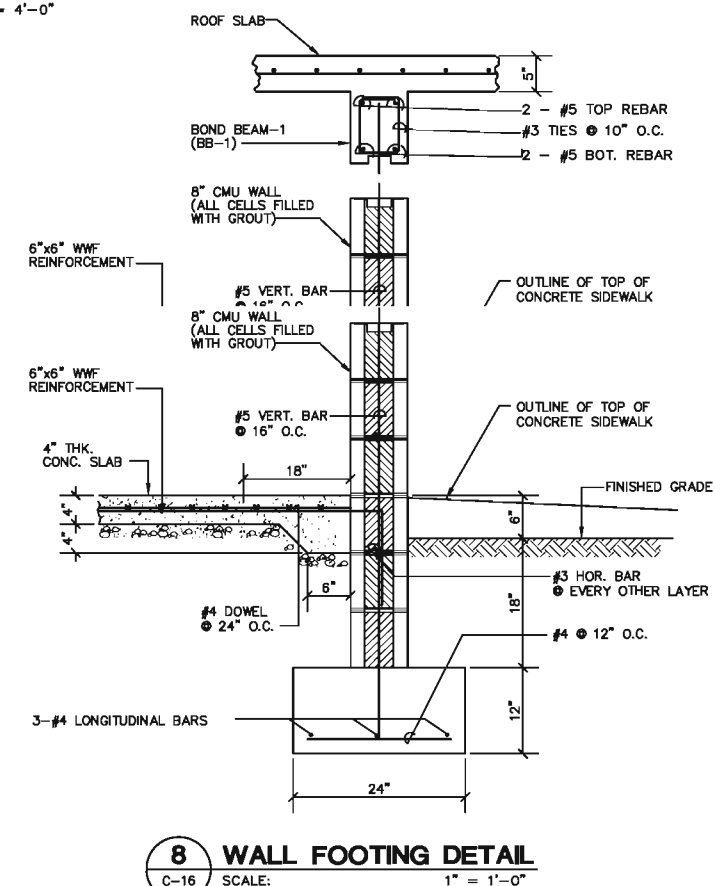
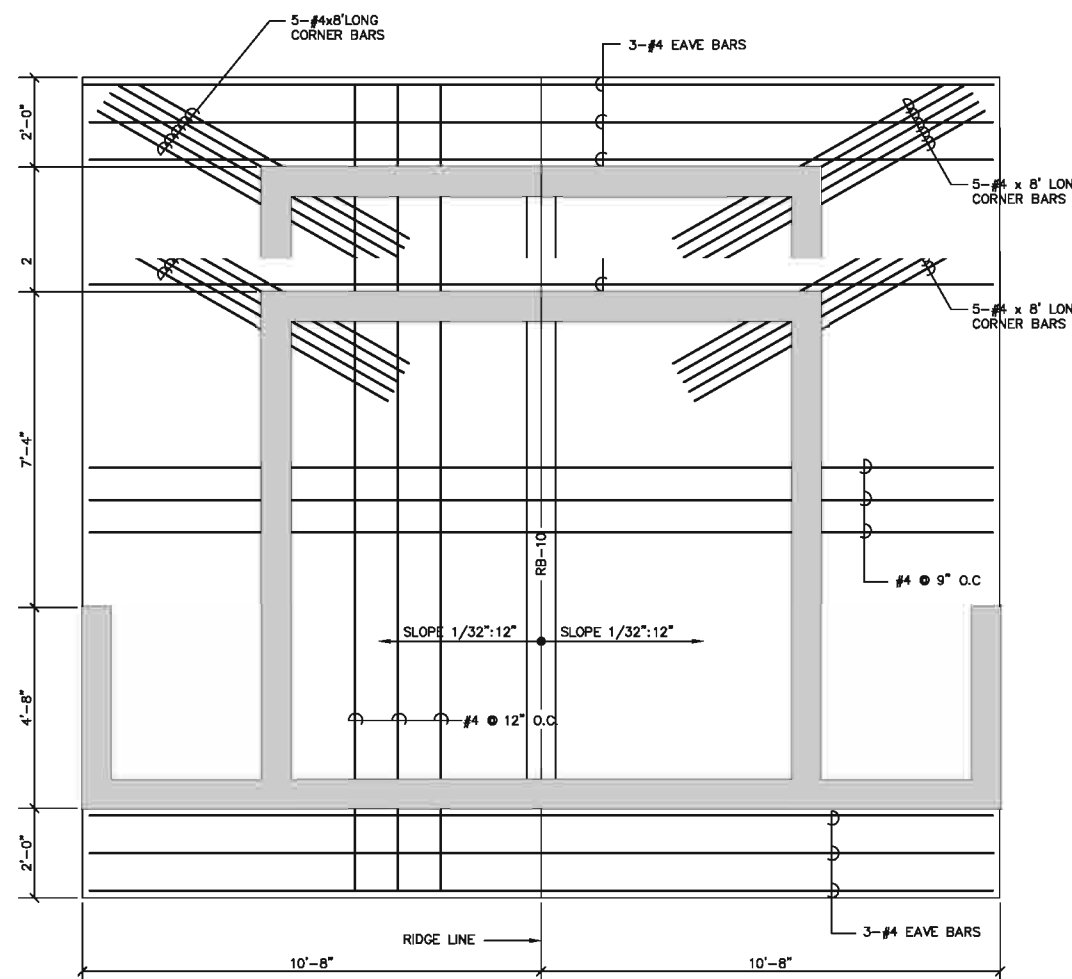
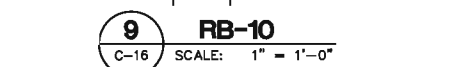
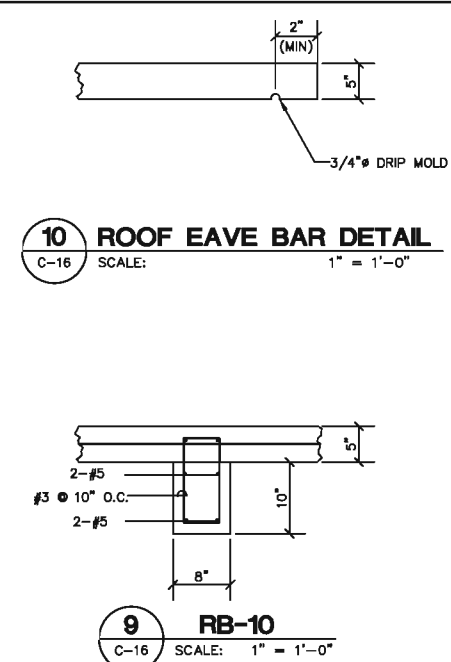
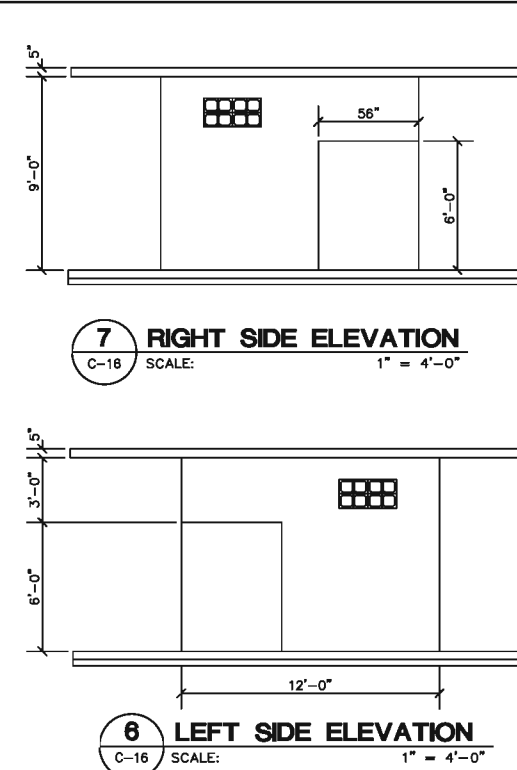
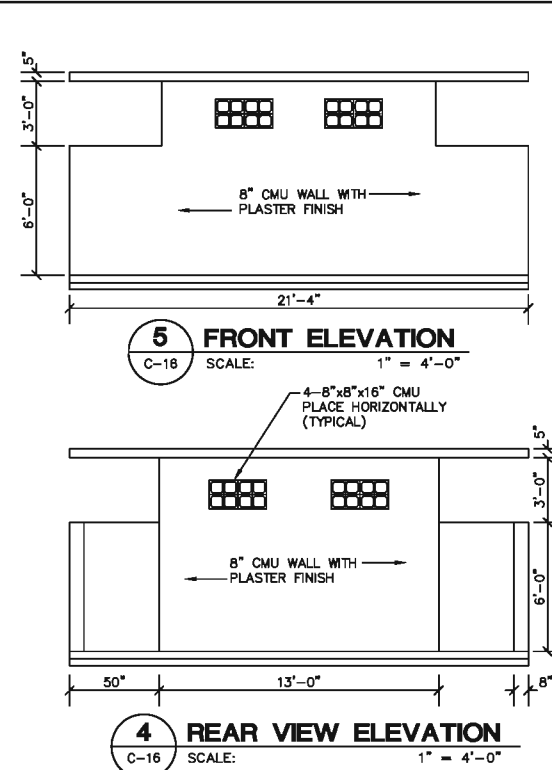


NOTE:

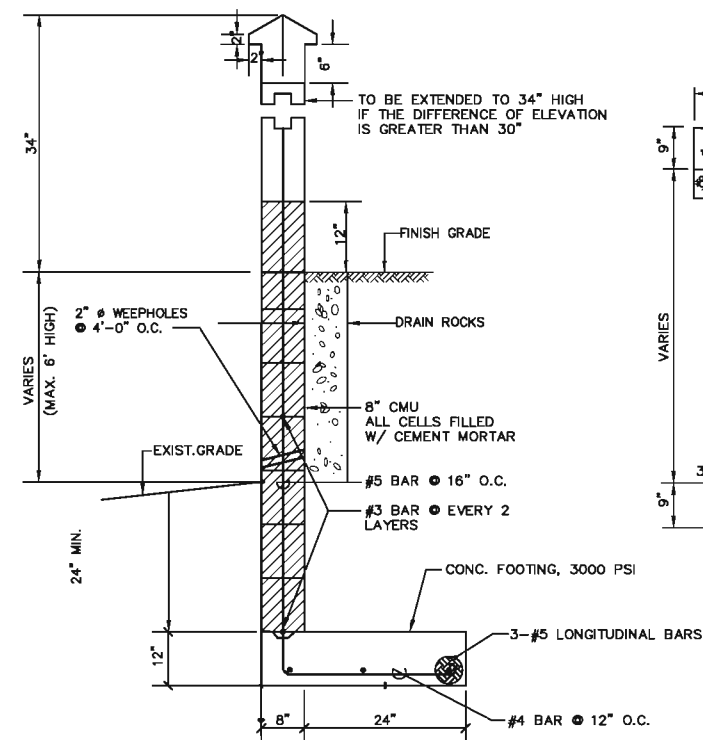
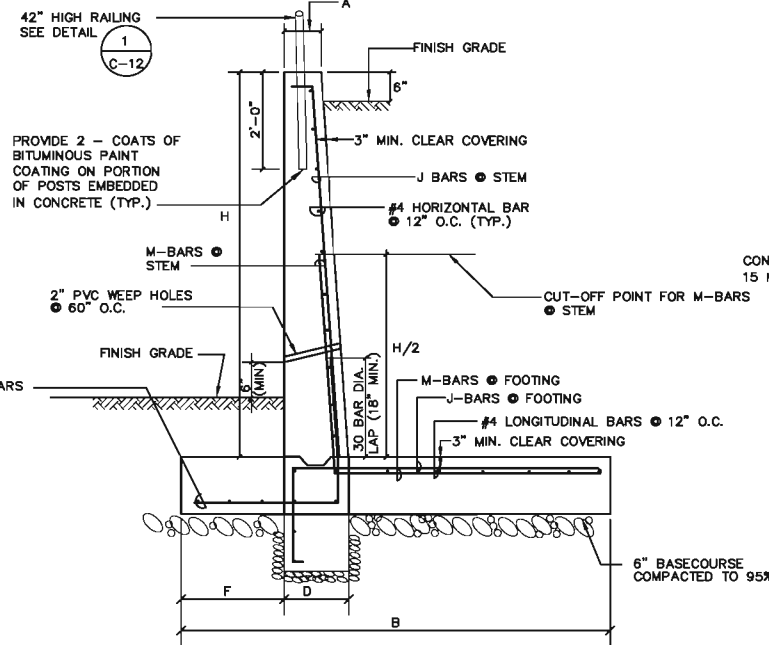
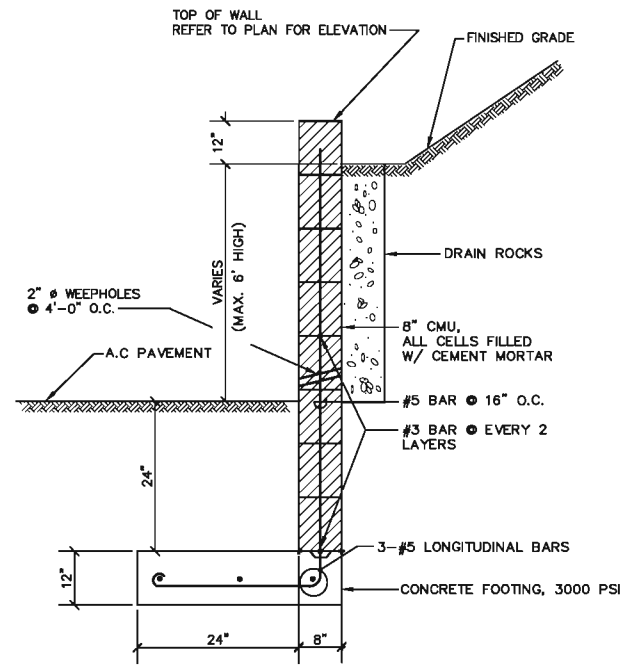
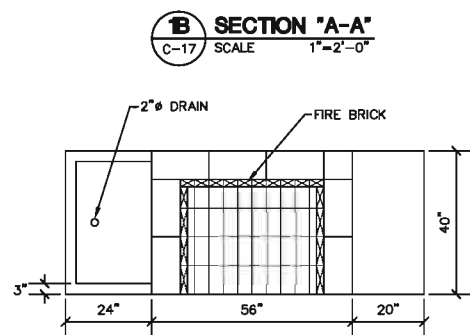
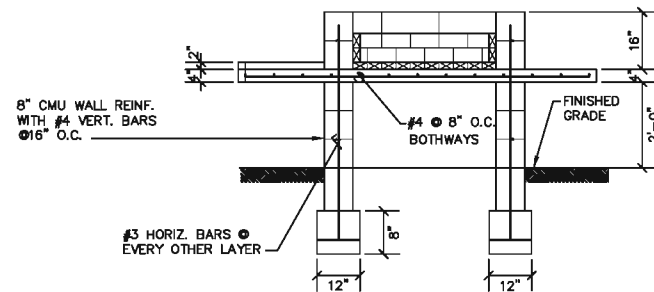
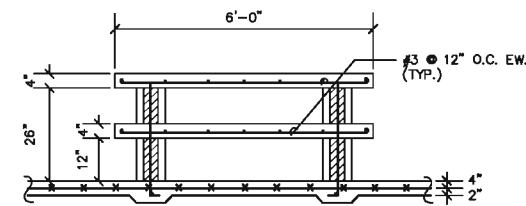
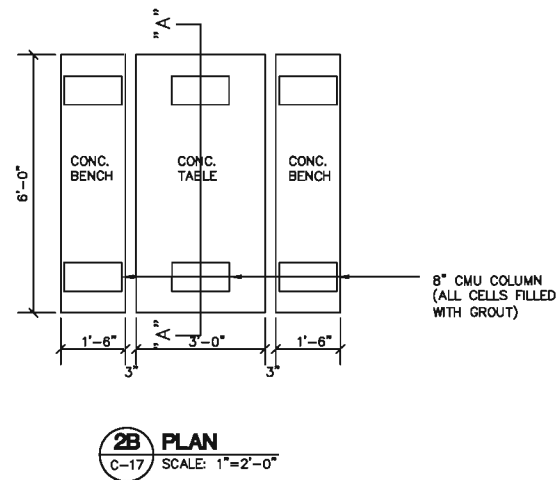
1. WATER CLOSET SHALL BE 17" TO 19" HIGH. SEATS SHALL NOT SPRUNG TO RETURN TO A UPRIGHT POSITION
2. GRAB-BAR SHALL BE 33"-36" HIGH
3. FLUSH CONTROL SHALL BE 44" MAX. HIGH ABOVE THE FINISH FLOOR
4. TOILET PAPER DISPENSER SHALL BE INSTALLED ON THE SIDE WALL, BELOW THE GRAB BAR, A MINIMUM OF 19" ABOVE THE FLOOR, AND MAX. 36" FROM REAR WALL
5. LAVATORY SHALL EXTEND 17" MIN. FROM WALL. CLEARANCE OF 29" MIN. SHALL BE PROVIDED FROM FINISH FLOOR. SHALL BE MOUNTED WITH RIM OR COUNTER SURFACE NO HIGHER THAN 34" ABOVE FINISH FLOOR
4. TOILET PAPER DISPENSER SHALL BE INSTALLED ON THE SIDE WALL, BELOW THE GRAB BAR, A MINIMUM OF 19" ABOVE THE FLOOR, AND MAX. 36" FROM REAR WALL
5. LAVATORY SHALL EXTEND 17" MIN. FROM WALL. CLEARANCE OF 29" MIN. SHALL BE PROVIDED FROM FINISH FLOOR. SHALL BE MOUNTED WITH RIM OR COUNTER SURFACE NO HIGHER THAN 34" ABOVE FINISH FLOOR
6. FAUCET CONTROL SHALL BE OPERABLE WITH ONE HAND AND SHALL NOT REQUIRE TIGHT GRASPING, PINCHING, OR TWISTING OF THE WRIST



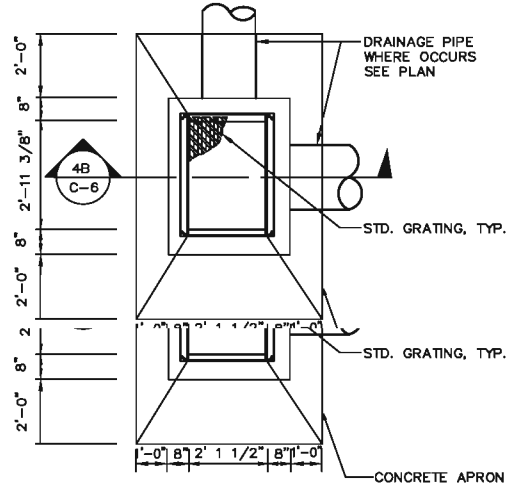
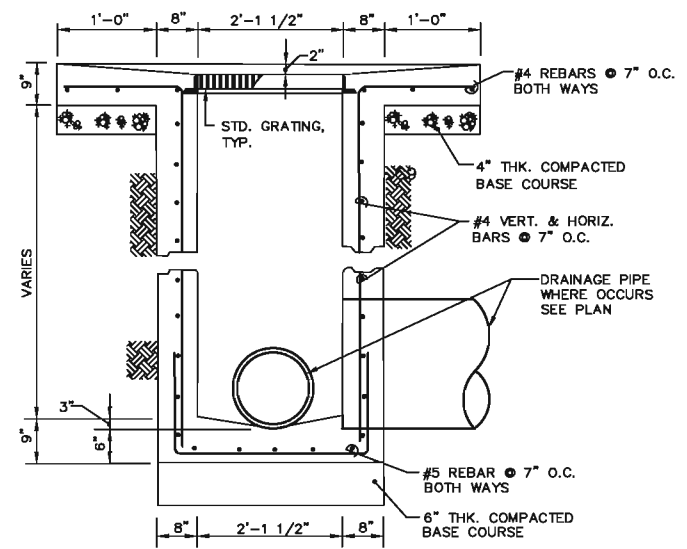
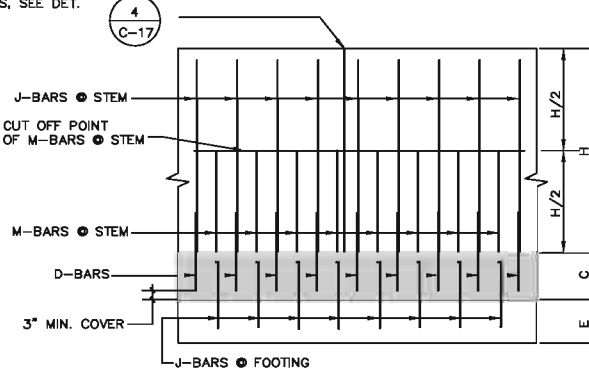
NOTE:
FOR PLUMBING PLAN
SEE SHEET C-17



REVISION	DATE	BY	DESCRIPTION		APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)		
CONTRACT No.					
DESIGNED BY: JMC			RESTROOM DETAILS		
DRAWN BY: JMC					
CHECKED BY: EMS					
SUPV. BY: EMS					
PROJECT ENGINEER			RECOMMENDED BY:		
			CHIEF OF ENGINEERING		
			DATE		
SECTION MANAGER			DRAWER		



REINFORCING BAR SCHEDULE AND DIMENSIONS									
H	A	B	C	D	E	F	D-BARS	M-BARS	J-BARS
8'	10'	68"	12"	12"	14"	24"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.
10'	10'	81.5"	12.5"	12.5"	17.5"	24"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.
12'	10'	100"	13"	13"	23"	33"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.
14'	10'	115.8"	15"	13.5"	27"	36"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.
16'	10'	131"	18.5"	14"	36"	45"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.
18'	10'	152.5"	22"	14.5"	36"	48"	#5 @ 12" O.C.	#5 @ 12" O.C.	#5 @ 12" O.C.



PRELIM SUBMITTAL

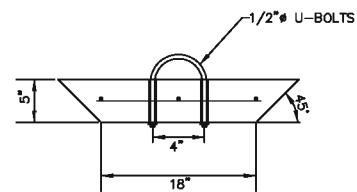


REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: JMC				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
CHIEF OF ENGINEERING				
DATE				
DRAWER				

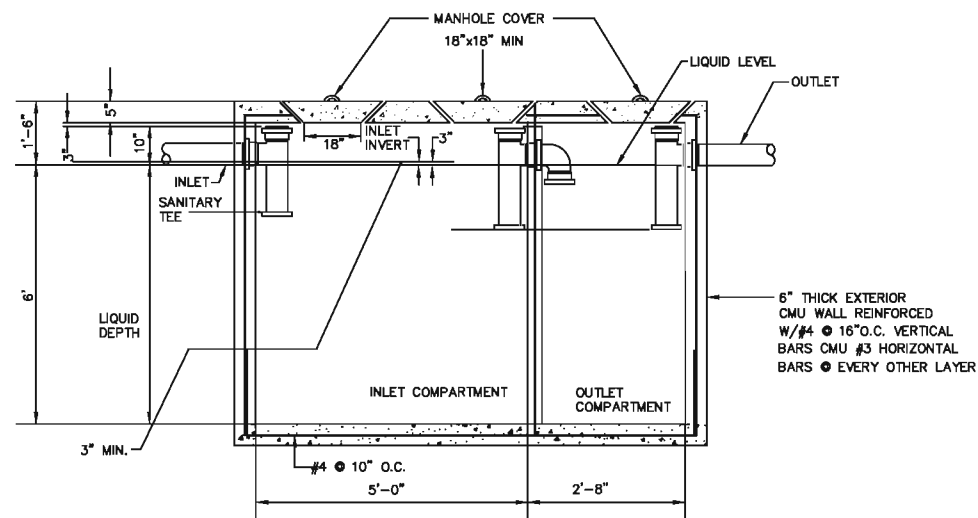
GOVERNMENT OF GUAM
DEPARTMENT OF AGRICULTURE
(DIVISION OF AQUATIC AND WILDLIFE RESOURCES)

MISCELLANEOUS DETAIL

RECOMMENDED BY:

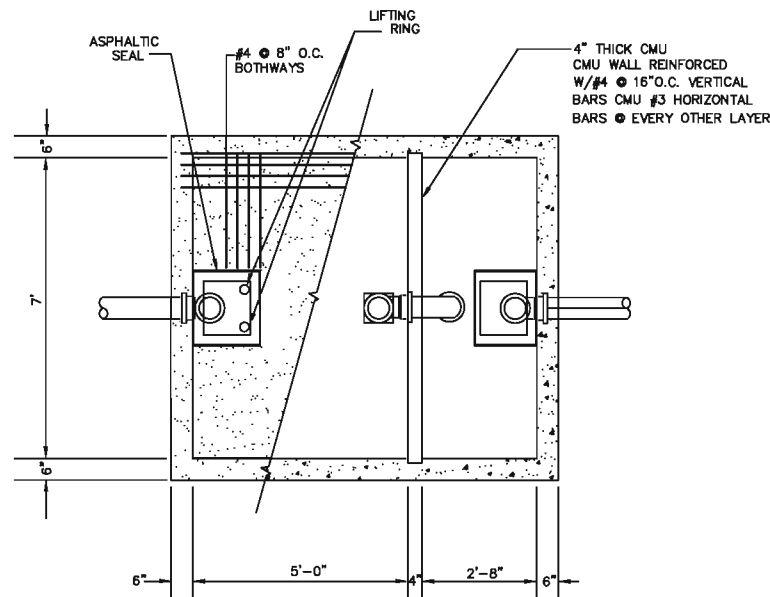


1C MANHOLE COVER
C-18 NOT TO SCALE



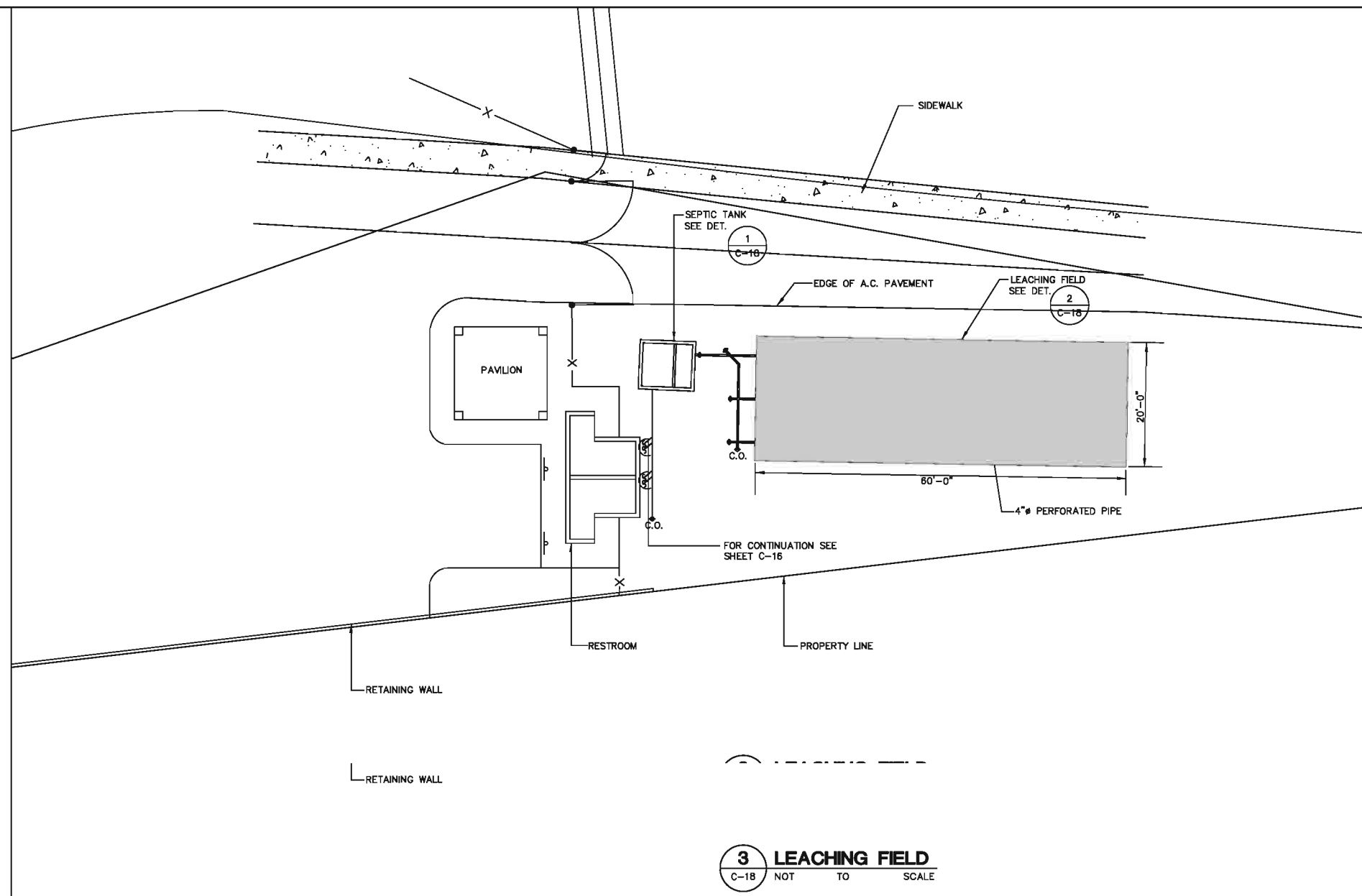
1B SECTION
C-18 NOT TO SCALE

1B SECTION
C-18 NOT TO SCALE

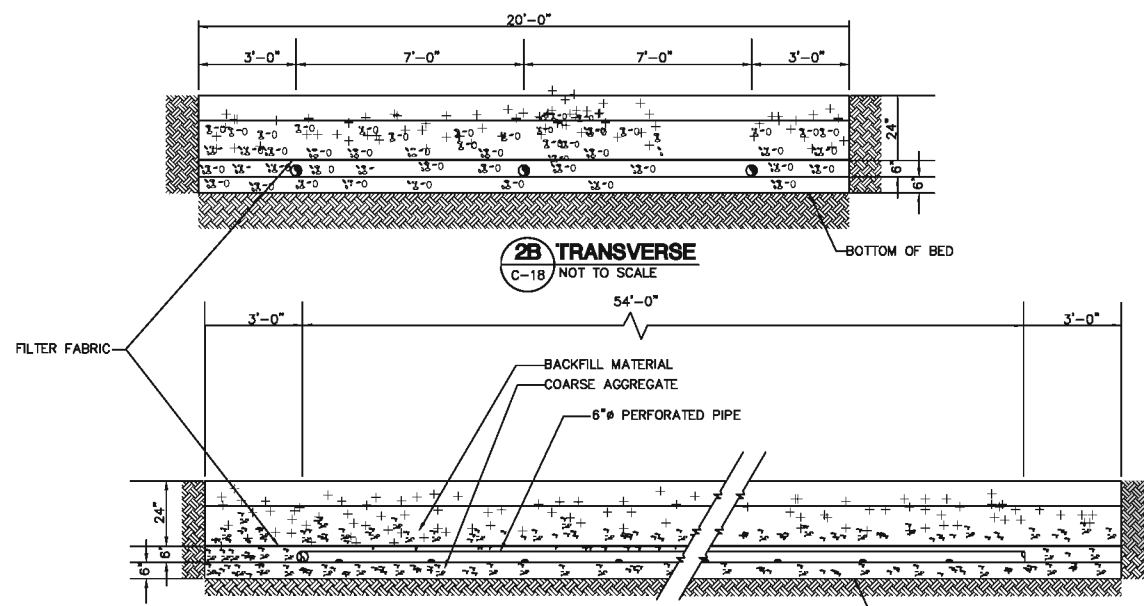


1A PLAN
C-18 NOT TO SCALE

1 DOUBLE COMPARTMENT SEPTIC TANK
C-18 NOT TO SCALE



3 LEACHING FIELD
C-18 NOT TO SCALE



2B TRANSVERSE
C-18 NOT TO SCALE

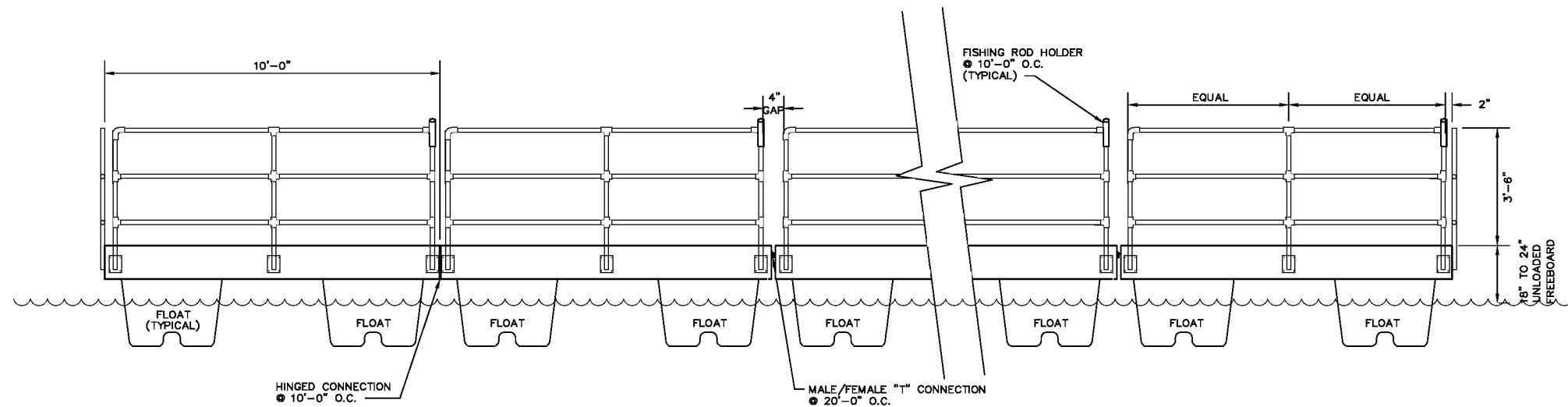
2A LONGITUDINAL
C-18 NOT TO SCALE

2 LEACHING FIELD
C-18 NOT TO SCALE

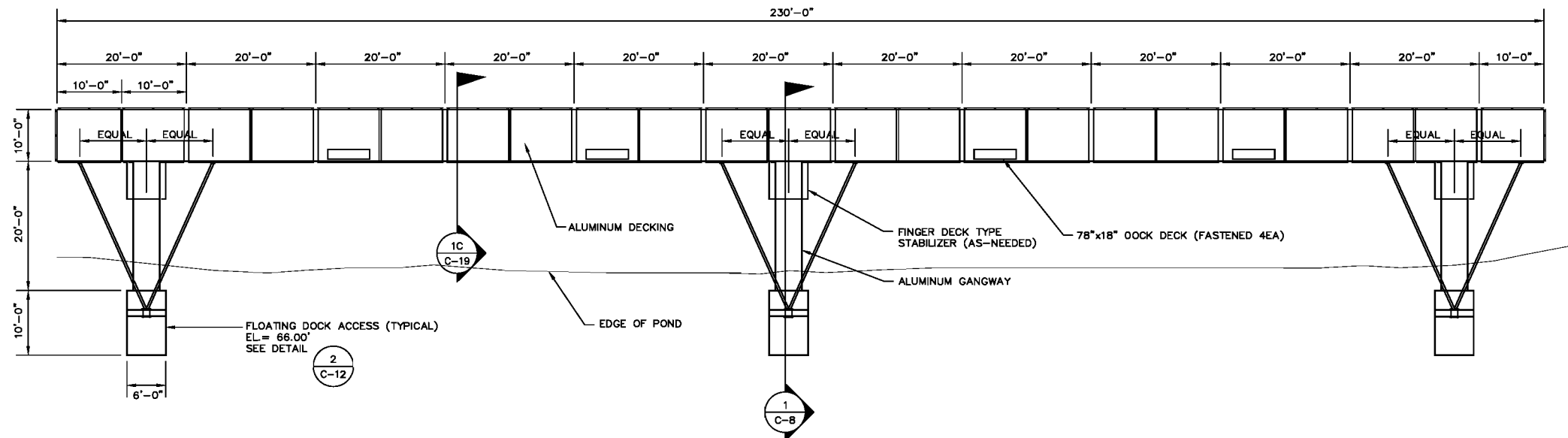
FINAL SUBMITTAL



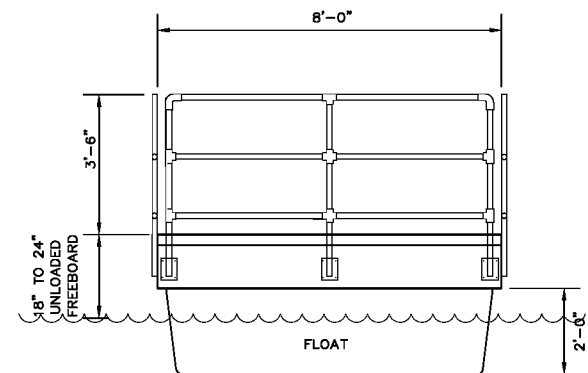
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.				
CONTRACT No.				
DESIGNED BY: JMC				
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS				
PROJECT ENGINEER				
SECTION MANAGER				
GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)				
SEPTIC TANK AND LEACHING FIELD DETAILS				
RECOMMENDED BY:				
CHIEF OF ENGINEERING DATE				
DRAWER				



1B FLOAT AND REAR ELEVATION
C-19 SCALE: 1" = 2'-0"



1A PLAN
C-19 SCALE: 1" = 10'-0"



1C END ELEVATION
C-19 SCALE: 1" = 2'-0"

1 FLOATING DOCK
C-19 SCALE: 1" = 10'-0"

FLOATING DOCK GENERAL SPECIFICATION

FLOATING DOCK

- STRUCTURE:**
HOT DIPPED GALVANIZED, WELDED STEEL FRAME MADE FROM 3/8" THK. 9"H X 3 1/2"W FLANGE FORMED CHANNEL.
- DECKING:**
8.625" x 1.625" 6061-T6 EXTRUDED RIBBED DECKING WELDED TO OUTER RAIL AND LONGITUDINAL STRINGER.
- FLOATS:**
MOLDED FROM TOUGH HIGH DENSITY POLYETHYLENE AND FOAM FILLED WITH 2 POUND DENSITY URETHENE FOAM, (5 YEAR WARRANTY).
- FREEBOARD**
16" TO 24" NOMINAL UNLOADED FREEBOARD.

ALUMINUM ADJUSTABLE GANGWAY

- SIDE MEMBER:**
10.188" EXTRUDED 6061-T6 SIDE MEMBER.
- DECK/STEPS:**
8.625" x 1.625" 6061-T6 EXTRUDED RIBBED DECKING.
- HANDRAILS:**
6061-T6 EXTRUDED 1 1/2" SCHEDULE PIPE, BOLTED TO OUTER SIDE MEMBER.
- WEIGHT:**
NOT TO EXCEED 700 LBS.
- CONNECTION TO FLOATING DOCK ACCESS SHALL BE AS PER MANUFACTURERS RECOMENDATION.**

FLOATING DOCK RAILINGS

- RAILINGS:**
 - 1 1/2" SCHEDULE GALVANIZED PIPE.
 - FITTING SHALL BE GALVANIZED MALLEABLE IRON, SLIP-ON PIPE ATTACHED WITH CASE HARDENED SET SCREWS.
- 4" G.I. PIPE STABILIZER**
- 4" PIPE SCHEDULE 40 GALV. PIPE.
- ALL CONNECTION SHALL BE WELDED.
- STABILIZER AND FLOATING DOCK CONNECTION SHALL BE AS PER MANUFACTURERS RECOMMENDATIONS.

LOAD DESIGN CRITERIA

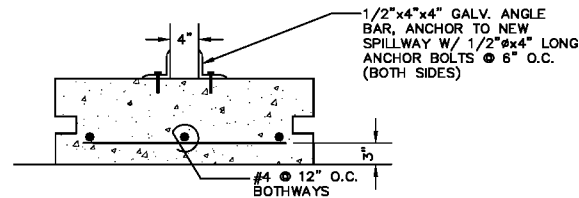
- LIVE LOAD = 50#/SF
- DEAD LOAD = 50#/SF

FINAL SUBMITTAL

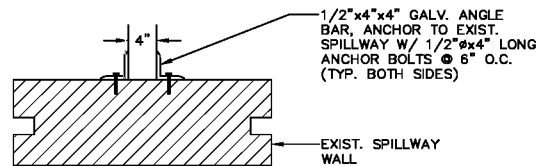


EXPIRATION: SEPT. 30, 1999
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

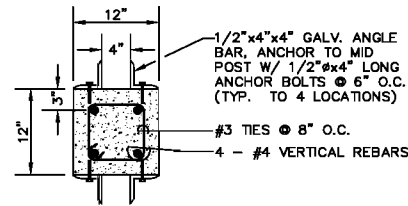
REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.			FLOATING DOCK DETAILS	
DESIGNED BY: RDD				
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS			RECOMMENDED BY:	
PROJECT ENGINEER			CHIEF OF ENGINEERING	
SECTION MANAGER			DATE	
SCALE: AS SHOWN			DRAWER	
			DRAWING NUMBER	
			C-19	
			SHEET 20F 24	



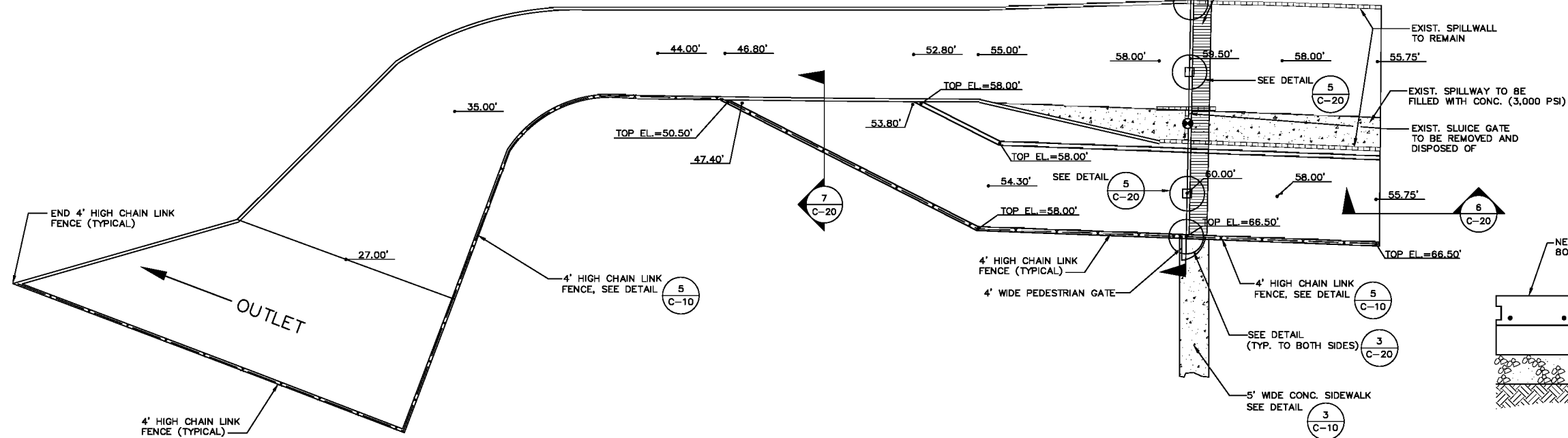
3 SECTION DETAIL
C-20 SCALE: 1" = 1'-0"



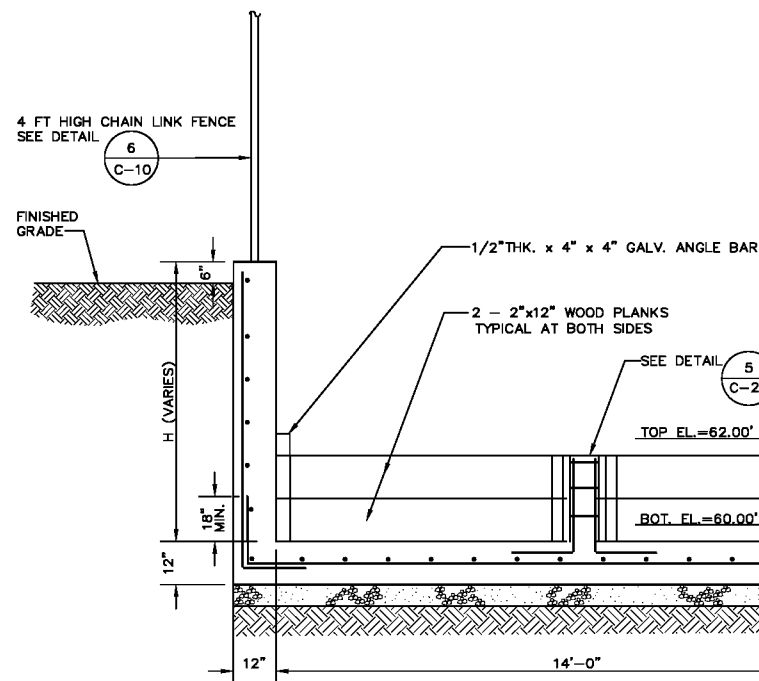
4 SECTION DETAIL
C-20 SCALE: 1" = 1'-0"



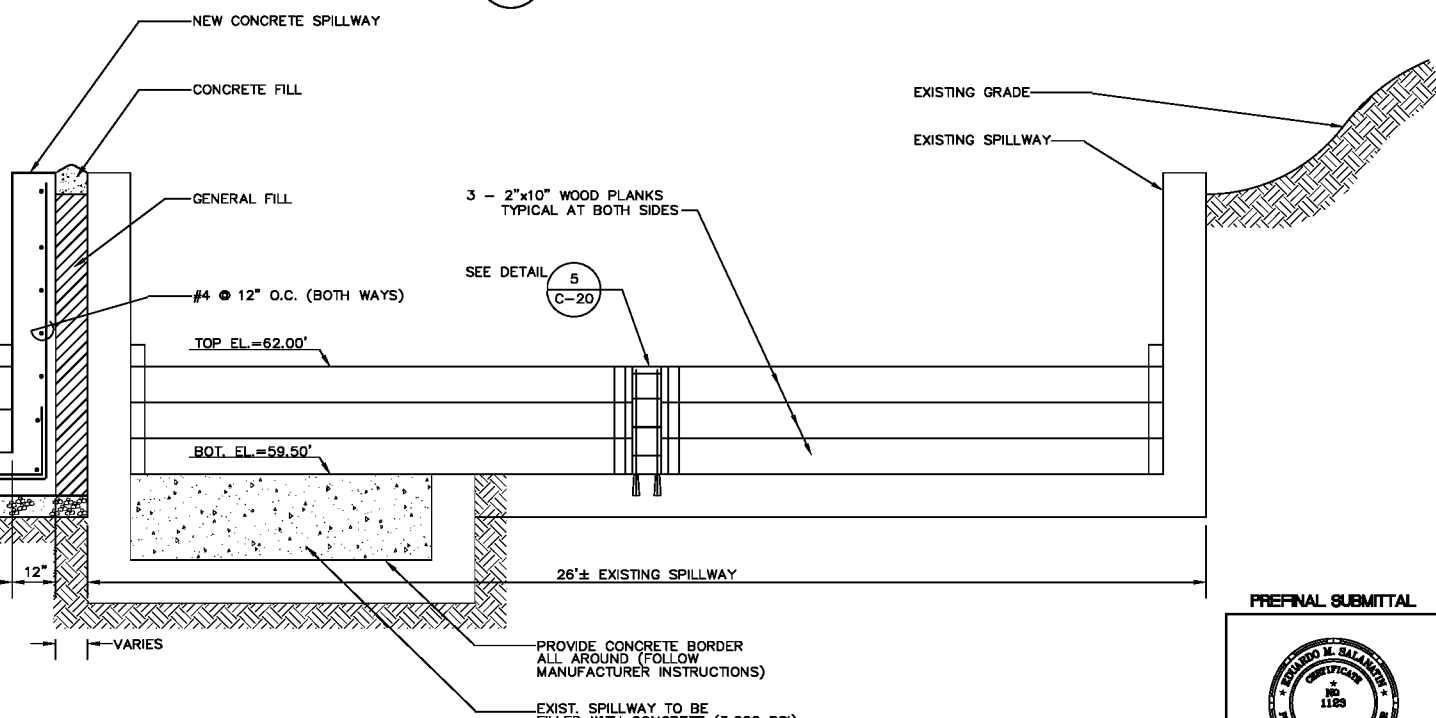
5 SECTION DETAIL
C-20 SCALE: 1" = 1'-0"



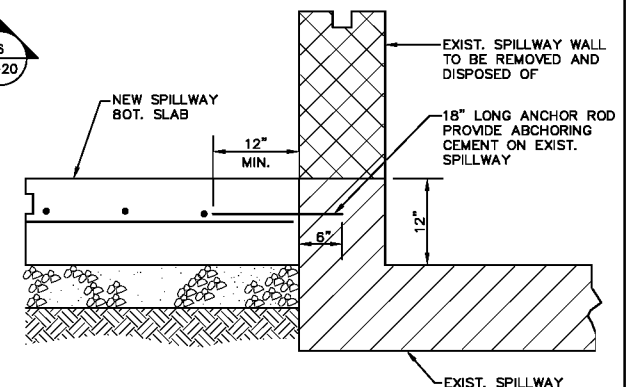
2 SPILLWAY PLAN
C-20 SCALE: 1" = 10'-0"



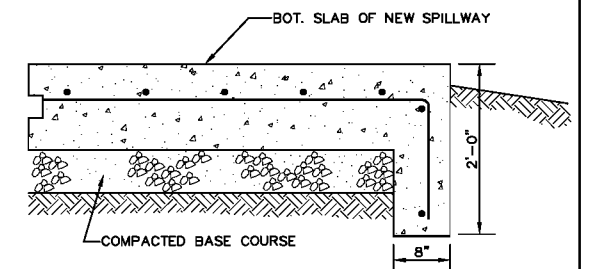
6 SECTION DETAIL
C-10 SCALE: 1" = 1'-0"



1 CONCRETE SPILLWAY SECTION
C-20 SCALE: 1/2" = 1'-0"



7 SECTION DETAIL
C-20 SCALE: 1" = 1'-0"



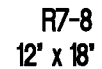
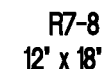
6 SECTION DETAIL
C-20 SCALE: 1" = 1'-0"

PRELIMINARY SUBMITTAL




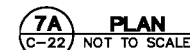
EXPIRATION (SEPT. 30, 1999)
THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

REVISION	DATE	BY	DESCRIPTION	APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)	
CONTRACT No.			SPILLWAY DETAILS	
DESIGNED BY: RDD				
DRAWN BY: RDD				
CHECKED BY: EMS				
SUPV. BY: EMS			RECOMMENDED BY:	
PROJECT ENGINEER			CHIEF OF ENGINEERING	DATE
SECTION MANAGER			Duettas & Associates <small>*ENGINEERING PLANNING SURVEYING DRAWING DESIGN CONSTRUCTION SERVICES*</small> <small>P.O. BOX 1000 TITIAN, GUAM 96901</small>	DRAWER
SCALE: NONE				DRAWING NUMBER C-20
			SHEET 2 OF 24	



EXPIRATION (SEPT. 30, 1998)
THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

REVISION	DATE	BY	DESCRIPTION		APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)		
CONTRACT No.					
DESIGNED BY: JMC					
DRAWN BY: RDD			MISCELLANEOUS DETAILS		
CHECKED BY: EMS					
SUPV. BY: EMS					
PROJECT ENGINEER			CHIEF OF ENGINEERING		DATE
SECTION MANAGER					DRAWER
SCALE: NONE					DRAWING NUMBER
					SHEET 2 OF 24



REVISION	DATE	BY	DESCRIPTION		APPROVED
PROJECT No.			GOVERNMENT OF GUAM DEPARTMENT OF AGRICULTURE (DIVISION OF AQUATIC AND WILDLIFE RESOURCES)		
CONTRACT No.					
DESIGNED BY: JMC					
DRAWN BY: JMC			MISCELLANEOUS DETAIL		
CHECKED BY: EMS					
SUPV. BY: EMS					
PROJECT ENGINEER			RECOMMENDED BY:		
			CHIEF OF ENGINEERING		
SECTION MANAGER			DATE		
SCALE: AS SHOWN			<div><div>Dugas & Associates ENGINEERING - PLANNING - SURVEYING CONSTRUCTION SERVICES P. O. BOX 9082 GUADALUPE, GUAM 96901</div><div>DRAWER DRAWING NUMBER C-22 SHEET 20F 24</div></div>		



EXPIRATION: SEPT. 30, 1999